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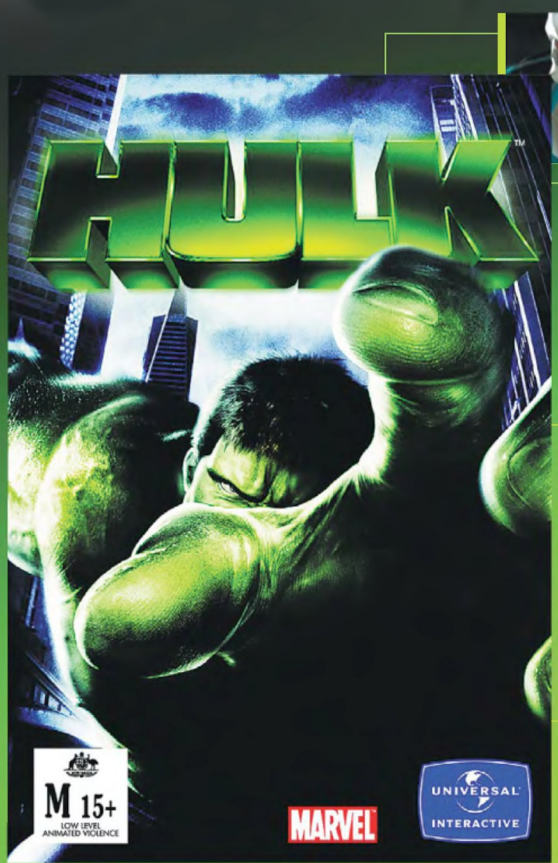

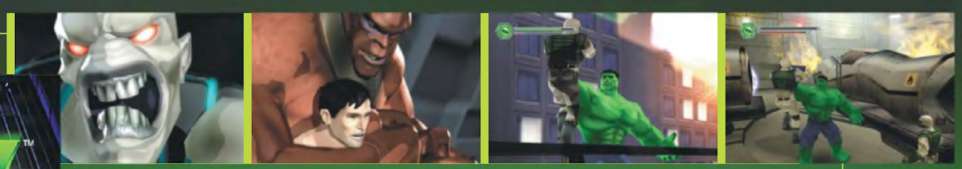

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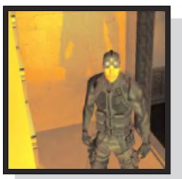

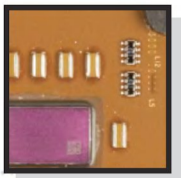

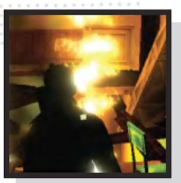
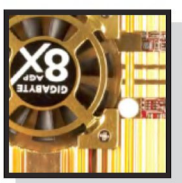

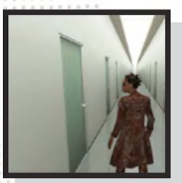

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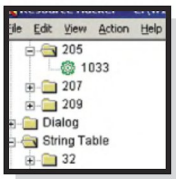

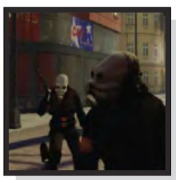

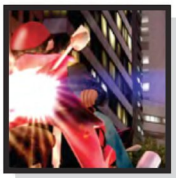

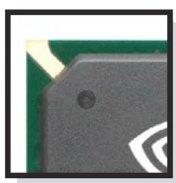

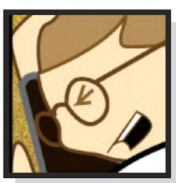

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Has there ever been a collection of games this big, ever? Probably at last year's E3, and the one before that, but who gives a flying X-wing about the past. New and shiny (pixel shaders ahoy!) was the highlight this year, and John Gillooly has it all in the flashy flesh.

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Unbelievable. Absolutely unbelievable. Your here, at the contents page, when you could be experiencing the gratifing feeling of reading the subs page. Go and read. It.

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Tech support. . . scaffolding for your system. Braces for your box. Thingos for your thingy. Nope, they don't work; 'scaffolding' guru Dan Rutter just doesn't sound right.

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Everyone knows how to tidy their desktop or hard drive. But have you given any thought to your poor registry. Day in, day out, it gets a beating from everything you install (and uninstall). Do some gentle caressing and show it you care.

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Why should your vid card miss out on that water-cooling sweetness? Ron Prouse shows you it can get some action too.

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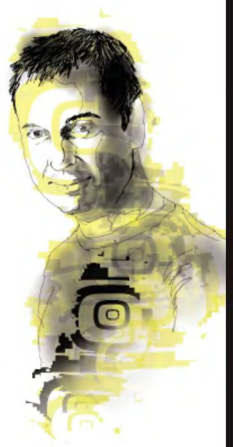
Sick and tired of people starting sentences with sick and tired? Then join John Simpson and his underpants antics.

The Freedom Box



It's known as 'case modding'. Such an ugly term. . . false, too. For modders mod far more than merely the case itself. And 'modding'? Isn't that the town where Noddy lived? Damn well should be, if it isn't.

Hot BoXXOring is the love that satisfies, with the computer's owner giving as much back to the machine as they receive from it. It's reciprocal user-computer love.

The art of case modding was well underway when *issue 1* of *Atomic* landed. We put it in the mag because, like overclocking and sucking at Counter-Strike, it was just another important part of the sub-culture that we call home.

In actuality, case modding started at the dawn of the Personal Computer Era in 1975, when the MITS Altair 8800 arrived from outer space and landed as a DIY kit in *Popular Mechanics*. Since then we've seen creativity explode like the Harbour Bridge on New Year's Eve. Once, the Perspex window was a radical home-job. Now, all-perspex cases are sold at retail level. There was a day when a stick of neon attracted glares at the glows. Now, it's almost impossible to buy a motherboard in any other colour but lurid.

I compliment the manufacturers who have embraced the art of computer beautification. It took them a while, but at last we have off-the-shelf components to ensure that any machine we build is as far removed from the hateful Olivetti XT, running Wordstar, and representing only walled-in potential, which may or may not have been your first PC experience.

Now, it's not essential to mod to be a bad-arse Atomican haxxOr. Not even slightly. It is but one way we express what tickles us. To those that do, though, we proudly present to you, this issue, the inaugural annual official recognition of the state of the case modder's art.

Atomic Hot Box of the Year. Boo yaa!

We couldn't have done a proper job of it without Compucon. This top Aussie company is as old as the hills, but as far seeing as the one on the other side. Over the last year, Compucon have chucked in very tasty monthly prizes, and a substantial booty of desirable toys for the Big One. Mad props for the recognition, guys.

Getting all organised and officialised, like, for Hot Box has let us extend it beyond just being the *Atomic* centerfold (front, not center, doesn't unfold), into the beautiful realms of *Atomic* democracy. It's now the *Freedom Box*. You'se, being the ultimate arbiters of taste, style and judgement, have voted on our site each month, to tap the bestest and ensure they are most justly rewarded.

And that's how we're doing Hot Box of the Year. Or 'Freedom Box 2003' as I think I like to call it. Maybe. Perhaps HotBOTY? Starting on *page 18* – traditionally home base for *Atomic* Hot Box, and whacking over five pages of eye-riveting glory, are the 48 boxes we've shown over the last year. It's a wake-up call for anyone inspired, just to see them all in one fat lump. It sure tingles the love, that's for sure.

Stare at it all for a few days. And, anytime before the 16th of July, head off to www.atomicmpc.com.au and punch the HotBOTY logo, and give it to The One that Deserves.

Words can't describe the excitement. So we'll use pictures as well, to announce the winner in *Atomic 32*. OMFG.

Ben Mansill
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SHORT CIRCUITS

PRIZES FOR CURRENT SUBSCRIBERS! It's true! Those already receiving monthly *Atomic* sweetness need only rest back and relax for a chance to win. Check out *page 105* for details.

Thought 2.2GHz out of an 1800+ XP Thoroughbred-B was a vicious overclock? Try 2.8GHz from a 1700+ XP. Considering the 1700+ runs at 1.47GHz, that's a 100% ramp in speed. Seems unbelievable? Apparently JIUHB 1700+'s are quite happy with 40-105% overclocks, thanks to the purity of the cores. For more information check out www.madshrimps.be/?action=getarticle&number=1&artpage=288&articID=84.

Did it ever really cool down? It's only been a few months, and NVIDIA and Futuremark are again engaged in a PDF war. Recently NVIDIA was accused of cheating with its 44.03 and 43.51 drivers (the latter supposedly WHQL certified). Certain 'optimisations' introduced with these drivers artificially boosted the 3DMark03 scores of the GeForce FX 5900. The optimisations include static clip planes and custom pixel shader routines to reduce the card's workload – but only for the benchmark. Once Futuremark updated 3DMark03 to make it invisible to the 5900, the card's scores dropped by 24.1%.

VIA has released a new version (4.47) of its Hyperion 4in1 drivers, designed to increase the performance of KT400 and P4X400 chipsets. While it's advised you only update your drivers when you encounter problems, we're definitely not advocates for the 'it's not broke so don't fix it' party. Go nuts and grab the drivers from www.viaarena.com

NEWS

Too good privacy

They huffed and they puffed but still couldn't break the code down. . .

Think yourself a bit of a master of the universe? How about captain of the cosmos? Space spinner of fate, time and Tholian webs?

It really wouldn't matter; even with the awesome power of the galaxy at your godly fingertips, it'd still take you many millions of years to crack a PGP encryption. Such is the way of the public key, and is the tricky situation the FBI is pondering. Unfortunately it doesn't have the extraterrestrial communication abilities of Fox Mulder to contact said defender of the stars and ask for computational aid. Nat.

In its grubby hands are two or three Psion PDAs (neither the FBI or the Italian Police have released significant information regarding their efforts or the shootout) from Nadia Desdemona Lioce. Nadia is a female Red Brigades member who was apprehended after a shootout between police on a train in Italy. They believe one of the PDAs hides some very tasty information about the group, which was responsible for political assassinations and instability during the 70s and 80s. But they can't get to it, thanks to Phil Zimmermann's Pretty Good Privacy (PGP) encryption.

PGP uses a public key, generated for use with any data you want to encrypt and send to mates. It was originally designed for email, but nothing stops you from using it to simply encrypt data, and keep it away from prying eyes.

Zimmermann no longer owns PGP, having sold it off to Network Associates back in 1997. The company unsuccessfully tried to integrate it into its software, and has since rescinded support. PGP itself is freeware, and can be downloaded online along with its source. The software was good enough to cause authorities some concern, and poor Phil ended up as the target of a three-year criminal investigation.

BELOW: **Phil Zimmermann: Three-year suspected crim?**

Phil's fairly certain the FBI won't break the code and gain access to the information. Brute force will take a *very* long time, and PGP has no back doors – it *was* started as a freedom of rights project. 'The very best encryption available today is out of reach of the very best cryptanalytic methods that are known in the academic world, and it's likely to continue that way,' he said. 'If the device is running PGP it will not be possible to break it with cryptanalysis alone.' Have to feel sorry for the feds – nothing ever seems to work out – be it dresses, aliens or unbreakable codes.

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AUS EGAMER

Rather than write the month's usual miscellaneous news, I'm getting down and dirty with one of the best LAN tournaments to date. Offering server sponsorships and autoberth into this year's Australian Esports World Cup qualifier at The Bunker in June, the MGL end of season tournament at CA. L337 was always going to be a show. The weekend saw clan Ui smash through the early competition to take out the winner's bracket on Saturday with Jai-Tud coming back from a 14-2 thrashing to win its next five matches and take out the loser's bracket. Sunday dawned and the other 10 clans of the tournament went at it. Behemoths Everglide and XR beat their way into the winner's bracket final with Everglide taking it out 13-5, securing itself a place in the finals. XR dispatched Collusion grabbing the remaining spot. It was getting late, four clans stood out of 20 that had come. The semi's saw XR take out Jai-Tud with a surprising 13-0 in the loser's bracket and Everglide get over Ui 13-10 in the winner's bracket.

Ui then took out XR 13-4 to secure a spot in the final. Ui, coming from the loser's bracket, had to win twice to come away with the goods. The teams battled it out furiously on de_dust2, Ui came out victor 13-7. People were chomping nails as the teams dropped into de_nuke. A strong Everglide CT side saw it snatch an 8-4 victory before the switch to Ts. If CTs were impressive, it was the Terrorists that stunned. A quick rush to outside, ambushing Ui as it defended the hut won them the eco. It managed to secure the next four rounds to win. It was all over with clan Everglide taking it out 13-5. Cheers to everyone who played and GL HF to Everglide in the AU-ESWC finals in QLD.

Stuart Denham

Name that Jolt

Ever wanted to name a consumer product destined for eternal greatness? A product that will be consumed by billions of fellow geeks for many years to come? Surely you've heard then of Jolt, the majestic tonic of invigoration, and its potent glucose-boosting abilities?

Sugar – is there anything it can't do (beside spontaneously turn into Plutonium)? While one might use it to heighten their dreams of flaming carnivorous ducks with banana-flavoured spears, sugar (and a little caffeine) is also terrific for long LAN sessions, duking it out with Counter-Strike masters and Warcraft 3 gods, and early morning awakenings to less than awake body parts after said LAN and dueling antics. Short of taking an enlivening dose of electricity from your PSU or attaching 80mm fans to your eyelids, you can purchase yourself some juicy Jolt, which comes in convenient can-size servings. Enough to stay your mind and steady your hand – for whatever game either part may be indulging in.

Well, to add to all this hyper-magical revitalisation, Jolt's Master of the Brews has concocted a new, even more caffeine-pumped beverage. It just doesn't have a name yet. Desperately seeking an enlightened group in which to bestow this amazing task of titling, Jolt made the wise choice and has given the name creation process over to Atomicans! Which oozes fun like a jelly mold full of jelly, being squeezed by a gelatinous cube. Jelightful, we must say.

Transmit by Copper wire your names to joltnames@atomicmpc.com.au before July 16 2003, and there's a chance it might be used to name Jolt's new super drink of life. Mind you, if they're all turdworthy, Jolt reserves the right not to use any of the names. As usual, judge's decision is final and no correspondence will be entered in to. Quack.

atomican

How do we know what the Forums will be like in 40 years? Maybe it'll taste like Tasty Wheat, or even chicken. Hero Hulkster thinks he's worked out what the machines have in store for us. www.atomicmpc.com.au/forums.asp?s=1&c=1&t=10031 may be some indication, but how do we know it's real? What is real?

In one thread we have The Fuzz Damn You!'s daughter's appraisal of our user pics (forums.asp?s=1&c=1&t=10347). It's very succinct, it pulls some punches, and it helps Atomicans to see which pics are garbage. The other thread is about computers, posted by a user with the hacker alias 'cmdwedge' and talks about virtually every dumb thing someone has done because of computer games (forums.asp?s=3&c=12&t=597). One of these threads is very cute. And the other is not.

They're galleries, Atomicans, endless galleries, where case-mods are no longer made. They are displayed. For the longest time, I wouldn't believe it. And then I saw the galleries with my own eyes, watched other Atomicans post their cases so that other people can view them. And standing there seeing what it was, I realised that we have a case gallery (http://atomicmpcg.sniperhq.net).

Everything the Oracle has told me has come true. That there are Atomicans out there getting married and that those people, those people I should congratulate them. Just as one Atomican chrisg gets back from his honeymoon (forums.asp?s=1&c=1&t=11670), all round funkster funk_e announces his engagement. I and Atomicans everywhere wish both you and any other married Atomicans the best of futures with your much loved opposite halves.

I'd like to share a revelation that I've had in my time here. It came to me when I tried to classify who he was and I realised that General Chat is not actually sane (forums.asp?s=1&c=1&t=10020). Every sane poster on this planet instinctively tries to make friends with other people with their first post. But this person does not.

And finally, remember that we know – for certain – at some point in the early 21st century, all of mankind was united in celebration. We marvelled at our own magnificence as we gave birth to the AF. The Atomic Forums. A singular consciousness that spawned an entire race of Atomicans.

Wilkshake

POTM 30

Having seen all the 'I'm a Geek and I'm proud of it' posts on the whole wide internet, we thought that all the good ideas had been done to death. But no! ne()phyte has whacked together a new Geek Top 10 that's a sparkler. And funny because it's probably all true. Champion work, lad! An MX700 for you!

www.atomicmpc.com.au/forums.asp?s=2&c=9&t=2201

WHAT'S HOT

- Dynamic lights – shadow up, shadow down
- Enter the Dragon – the call of kung-fu
- E3 – entertainment cubed
- Half Life 2 – better than Half Life
- Asteroids – aliens, spaceships and guns

WHAT'S HOT

- Static clip planes – 3DMark up, 3DMark down
- Enter the Matrix – call someone who cares
- B2 – not as entertaining as B1
- Life – down to the last human
- Asteroids – tsunamis, dust and darkness

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26697

Nature Test

One's passion for performance and modding is a reflection of part of one's inner nature. Specifically, as Ashton Mills contemplates one's *Atomic* nature.

In Buddhism there is a term used to describe the inherent nature of who you already are, of the enlightenment you already have, That remains obscured only due to your inability to realise your own truth – your Buddha nature. In Western theology this is loosely translated to refer to one's inner *spirit*.

This provides us with an interesting parallel. For the tweaking, optimising, and performance obsessed individual (yes you, the one holding the Maximum Power Computing magazine) it's readily apparent to say that there is also an *Atomic* nature. That part of us that is technically inquisitive, ever striving for the ultimate in performance and modification, and which exhibits itself at various levels directly aligned to the time spent pursuing it.

> **This is most certainly the type of thing that only a person aware of their Atomic nature could possibly conceive of doing.**

I pondered this when I recently went to install two new Maxtor Atlas IV 10k RPM SCSI drives, to be hooked up, of course, in software RAID. For a start I suppose one could ask what type of nutcase spends a grand on drives just for a desktop system. Actually don't answer that, I haven't.

At any rate, any normal person might then just install Windows on said drives and be done with it. But he or she who recognises their *Atomic* nature can't do that. It's not about just *using* the damned devices, it's about making them into the best they can be. So, after installation comes the ritual downloading and installing of the latest drivers and updates for every conceivable piece of hardware in the system, often right on down to the BIOS.

So that's what I did after setting up a software RAID in XP, and also went the extra (and frankly necessary) mile to install George Breese's excellent VIA latency patch to get around the niggling PCI bandwidth bug in the KT400 chipset.

This is the bug that limits the PCI bandwidth and, while not visible with a standard single drive system, shows up quite readily when you start RAIDing drives and asking for speeds in excess of 80M/s. After George's patch, the two RAIDed Maxtor's jumped from 80M/s read to 110M/s. Sweet.

When it came to installing my Gentoo Linux boot, the truth of *Atomic* nature became abundantly clear. Not for the fact that I would be installing Linux, nor the fact (though it is relevant) that I'm installing Gentoo which is, by *its* very nature, a source code based distribution optimised for supreme performance. No, what I refer to is the steps I took to maximise my system right before I even began the installation.

After booting the install CD I first set the CFLAGS to optimise the distribution for my Athlon-XP, explicitly specifying to take advantage of MMX, 3DNOW and SSE support. This is really just par for Gentoo, and clearly an embodiment of *Atomic* Nature.

But then I installed CCACHE, the compiler cache. Normally one might do this after installation, but I wanted its ability to cache commonly used compiles to be available during installation to speed this up too.

Then I installed DISTCC, the distributed compiler. With the DISTCC client already running on my gateway box, this allows me to spread the compiling load over the network across both machines, combining raw CPU grunt to greatly reduce compile times. Since Gentoo compiles everything from source code, this is somewhat of a significant gain.

Still, however, I am not ready to bootstrap the install. The next step is to download the PCIUTILS package which contains a program called 'setpci' that allows me to directly set registers in the PCI chipset. This is most certainly the type of thing that only a person aware of their *Atomic* nature could possibly conceive of doing.

The first register I tweak is the Halt Detect bit in the KT400, allowing the idle temperate of my Athlon-XP to drop by 20 degrees Celsius and remain cool when ever it can, such as between compiles when it's downloading source from the Web. This is the same simple trick as your standard VCOOL or RAIN programs under Windows, all that was required was a bit of research on the correct register to use for the chipset, and set it with one simple command.

But I'm still not satisfied yet.

Remember the PCI bandwidth bug? There is no VIA latency driver for Linux. Given installation is going to be disk intensive, let alone afterwards when I use my Linux desktop, I want my system performing as fast as it can. So I had a chat with George about his VIA latency work-around, and with some invaluable guidance on his part, figured out the exact registers I needed to tweak and set them with setpci. Again, a 30M/s improvement. These commands would later be added to my startup scripts, along with the cooling command.

After all this, finally, I would bootstrap the install process.

Which, with Gentoo, leaves plenty of time to contemplate the *Atomic* nature. How far do you go when it comes to tweaking and performance? Is there such a thing as too much? Do you consider it time well spent?

My answers to these deep and meaningful questions are: far enough, probably not, and yes. But there's something else. For those aware of their *Atomic* nature it's as much about the journey, of building and accomplishing something, as the end result.

Building a highly optimised Linux boot isn't just about having a fast machine, it's also about knowing that I've *built it to be* a fast machine.

It all comes down to acknowledging that these passions for performance, to tweak and play, and to create something bigger and better are not just something we do for fun, but a part of who we are. That this isn't just a past time, but a reflection of what drives us. It is the core of our nature, our *Atomic* nature.

Ultimately, to recognise one's *Atomic* nature is to recognise that one is already, and always has been, *Atomic*.

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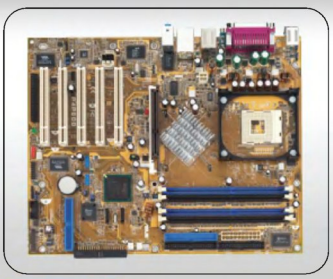

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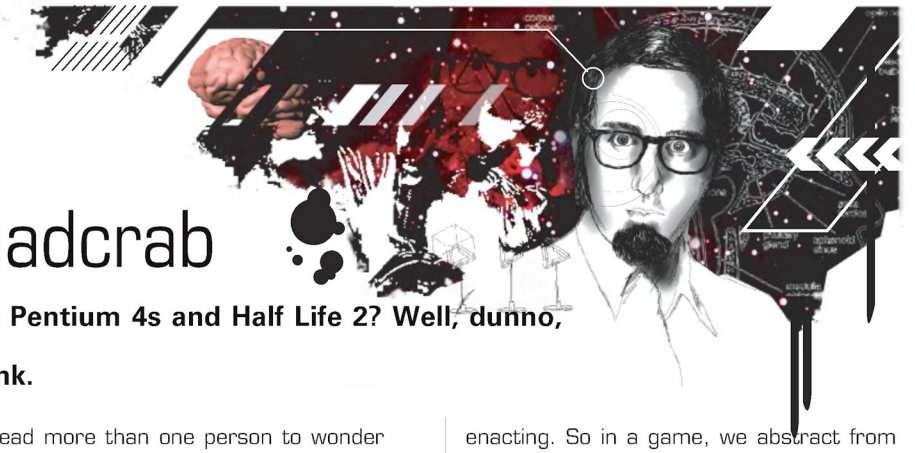

This is not a headcrab

What does cubism have to do with Pentium 4s and Half Life 2? Well, dunno, but Tim's going to try and find a link.

You know, 'concrete' and 'abstract' aren't just terms referring to building materials and art. Although, interestingly, they both have to do with the building blocks of reality, and they both make you sit back and take a long hard look at yourself – much like delving into a painting by Picasso or Pollock.

In fact, Paul Cezanne, the French impressionist painter, and arguably the father (or perhaps grandfather) of cubism once said: 'Everything in nature models itself on the cone, the cylinder and the sphere.' Now that's not so far off where you and I spend a lot of our time, where the primitive is the triangle instead of the cone, cylinder or sphere.

And that's no accident. You see, I think Cezanne was making a very interesting point, more about us than about nature – and I think his point translates to our computer and 3D gaming worlds.

He was talking from his observations of nature, where he noticed that objects could be seen to be made up of shapes, which in turn were made up of other shapes, and so on, until he reached 'primitives' – those shapes that cannot be further subdivided. The 'elements' of geometry, if you will.

Now this was a very useful observation for an artist (a painter, at least), as by the nature of their endeavour, they work with representations of things – not with the things themselves (ooh, I can already hear the post modernists racing to their retro Underwood #5 typewriter to bang out a letter beginning 'When will *Atomic* wake up and realise. . .' – now, now, there's no need – this is a technical article, and not one meant to delve the depths of art theory).

This point was brilliantly demonstrated by René Magritte (who, as it happens, is my personal favourite artist) in his work titled *Ceci n'est pas une pipe*. In this, Magritte has rendered a very realistic painting of a pipe (of the tobacco variety) although under it is written the words, in French, 'this is not a pipe' – which has lead more than one person to wonder what Magritte was in the habit of packing his bowl with. The point that Magritte was making is that this is a *picture* of a pipe, and not an *actual* pipe. In essence, it's a representation of a pipe – thus neatly summing up the fare of the humble painter and artist.

So, back to Cezanne's point about perception and primitives. I think his statement has an incredible significance regarding the way we look at the world. It's easy to see that objects are made up of shapes, and that these shapes can be reduced into things like spheres and cubes, but is the world *really* made up of spheres and cubes? Of course not – that's just the way we see it. So, Cezanne is not really talking about the way the world is, he's talking about the way *we* are – and how we perceive. This is important because the way we perceive tells us a lot about who we are.

> Prof. Joseph Davidovits believes pyramids were built from concrete. No hauling or crafting of stone, just some geopolymer cement and a litte casting. Crazy? It'd be easier than carving, and explains why all the joins are almost perfect. . .

"Which has lead more than one person to wonder what Magritte was in the habit of packing his bowl with. . ."

This brings me to the distinction between the concrete and the abstract. Essentially, concrete refers to things that have cold, hard existence in the world – sometimes defined in terms of spatiotemporal extension – which is just to say the buggers take up space.

Abstract things, on the other hand, are harder to define. They don't have cold, hard existence (although, ironically, 'cold' and 'hard' are abstract), and they don't take up space. So what are they? Well, the jury's still out, but I reckon they're just those things that are dependent on the mind for existence, and are related in some goofy way to concrete things (ooh, controversial. . .).

One way to illustrate the distinction that should be familiar to us gamers is, well, games. In a way, physically holding and swinging a sword at a knight is a concrete kind of thing to do. On the other hand, you can't actually physically do that in a computer game – although there's nothing but the promise of big purple bruises stopping you from doing it by re-enacting. So in a game, we abstract from the concrete excercise of holding, aiming, swinging and the physics of the weight and ark etc into numbers that represent these things.

Concrete is a steel longsword – abstract is 1D8 damage.

For this reason it seems as if the abstract is somewhat like the concrete, but with certain key aspects 'subtracted' from it, namely the spatiotemporal bits. I'm not sure I entirely agree with this particular line of thought, but it's a useful way to look at it.

And, now finally, for the point of this piece, I'd like to say that all computers are analog.

'Whoa, you putz', I hear you say, 'they're digital.' Well, yes, they are, but what do you mean by 'digital'?

Digital means breaking things down into discreet values, usually '1' and '0'. You can then run Boolean logic operations on them with the swiftness of eleven monkeys peddling away furiously under the hood (which I *think* is about equivalent to 3GHz in processor terms). The thing is, I reckon that the '1's and '0's are abstract things, and the only concrete things about them are the materials, structure and electromagnetic waves – the various voltage levels of which 'represent' the '1's and '0's, in the same way the brush strokes on the canvas 'represent' the pipe. So on the surface we see a lot of digital shenaniganry, but underneath, it's all analog waves, man. Bet that'll make you look funny at your next digital wristwatch.

And now for the thing that will really put chutney on your pappadam (or bake your noodle, in *Matrix* parlance) – if there were no humans around, with no minds perceiving the world, then would a CPU rendering a 3D scene still be rendering a 3D scene? Or would it be better described as a collection of concrete physical processes that, only if viewed by a human mind, would appear to be rendering a 3D scene?

And the answer to that one is well beyond me, but it makes you think, doesn't it?

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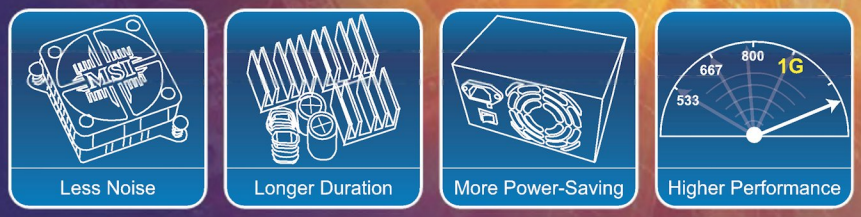

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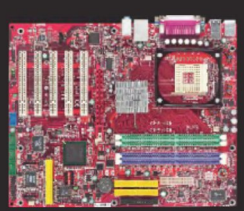

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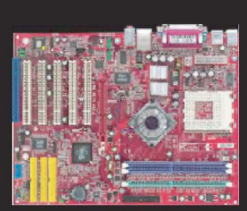

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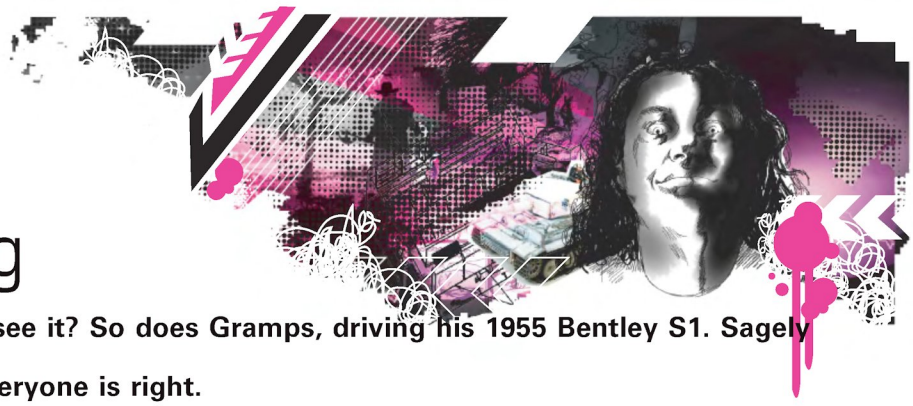


Doshprocessing

You know a good deal when you see it? So does Gramps, driving his 1955 Bentley S1. Sagely Daniel Rutter lets us know that everyone is right.

How much does a computer cost?

It depends on who you ask.

Ask a typical with-it *Atomic* reader and you'll get an itemised quote, featuring the latest tweaky motherboard with striped lime-green and 'International Safety Orange' PCB, a processor that's five steps down from the fastest one you can get but has an 83% chance of overclocking to 15% above the fastest one's sticker speed, a couple of sticks of RAM that total as much storage as sixteen thousand C64s, a video card that *preferably* takes up two slots but *requires* an auxiliary power cable, a case that weighs about as much as a milk carton and has a factory fitted side panel ant farm, and a smattering of other components chosen on the basis of a democratic survey of the opinions of *Atomic*, Tom, Anand, Kyle and Agg. And maybe me, if I'm really lucky.

The price of that little lot is likely to wind up around $2,000. Assuming you value your time assembling the thing at zero dollars an hour, that is.

Now, try asking someone's uncle who reckons he knows a bit about computers, seeing as how he's bought four brand name boxes since 1983.

He'll nip off to ibm.com.au or dell.com.au or the now-interchangeable hp.com.au and compaq.com.au, and play with the 'Build Your Own Box Your Nephew Will Laugh At' widget until he's come up with something with most of the CPU power of the above mentioned pile-o-components, almost enough RAM, a fatal flaw somewhere in the graphics subsystem (if he manages to get a fast video adapter, he'll probably pick a slow-response LCD monitor to go with it), and a case that seven out of ten focus group participants agreed looked 'serious, yet stylish'.

He'll probably pay at least three grand, because that's what a decently fast computer used to cost.

Now, try asking a Linux geek. Try to find a mellow, yet knowledgeable one – somewhere between the ones who get extremely angry if you don't say it 'GNU/Linux', and the fakes who don't even have a beard.

Hi-ho to ebay.com.au you'll go – or auctiontrader.com.au, in case it has a liquidation batch – in search of a perfectly serviceable used Pentium II box for a couple of hundred bucks. Shop carefully and you'll get a monitor as well, for that money. You'll probably be buying a superannuated business machine with 64MB of RAM; a well-used low capacity hard drive and The Worst Mouse You'll Ever Touch. But for unpretentious users of the Finnish OS, that's A-OK.

Search for used computers on tradingpost.com.au and you'll find a lot of people who need to be told 'they're dreaming'. But if you just need a basic box, hit the auction sites and you'll find that the price/performance ratio of unsexy machines two CPU generations behind the cutting edge really can't be beat. Just stay alert for CPU or PSU fan bearing failures.

Oh, yeah – spend another $400 on a new hard drive and more RAM than used to exist in the whole office where this thing lived, and a cheapo auction site P-II will happily run WinXP. Shh.

Now, go and ask an office PC procurement nebbish. In between soulful stares at the Dilbert cartoons on the walls of his cubicle and facial twitches, he'll spec out a $1,000 box that'll be on eBay for $150 by 2007.

He'll probably pare the price down by picking a P4 Celeron, a smallish monitor and the bare minimum RAM needed to run Windows, because, lets face it, nobody has ever been fired for making a computer that takes five minutes to boot.

His advice probably won't help you much, though, because the same box will cost you $1,500 if you don't have the buddy deal he has with his preferred supplier.

That deal's not worth what he had to do to get it. Trust me.

OK, so what does a computer cost, if you ask me?

Well, I'm not a big fan of brand name machines. I'll give you all a moment to get over your astonishment about that.

I suppose brand name boxes can be good for people who reckon they're likely to need a lot of support, but really, if you just want a computer for home stuff and you're not too PC-savvy, be sensible and get a Mac, OK?

If you are short of cash, check out the second-hand Macs on eBay. Perfectly good CRT iMacs, $500 to $1,000. Beige G3s cheaper than the old P-IIs. Bewdy.

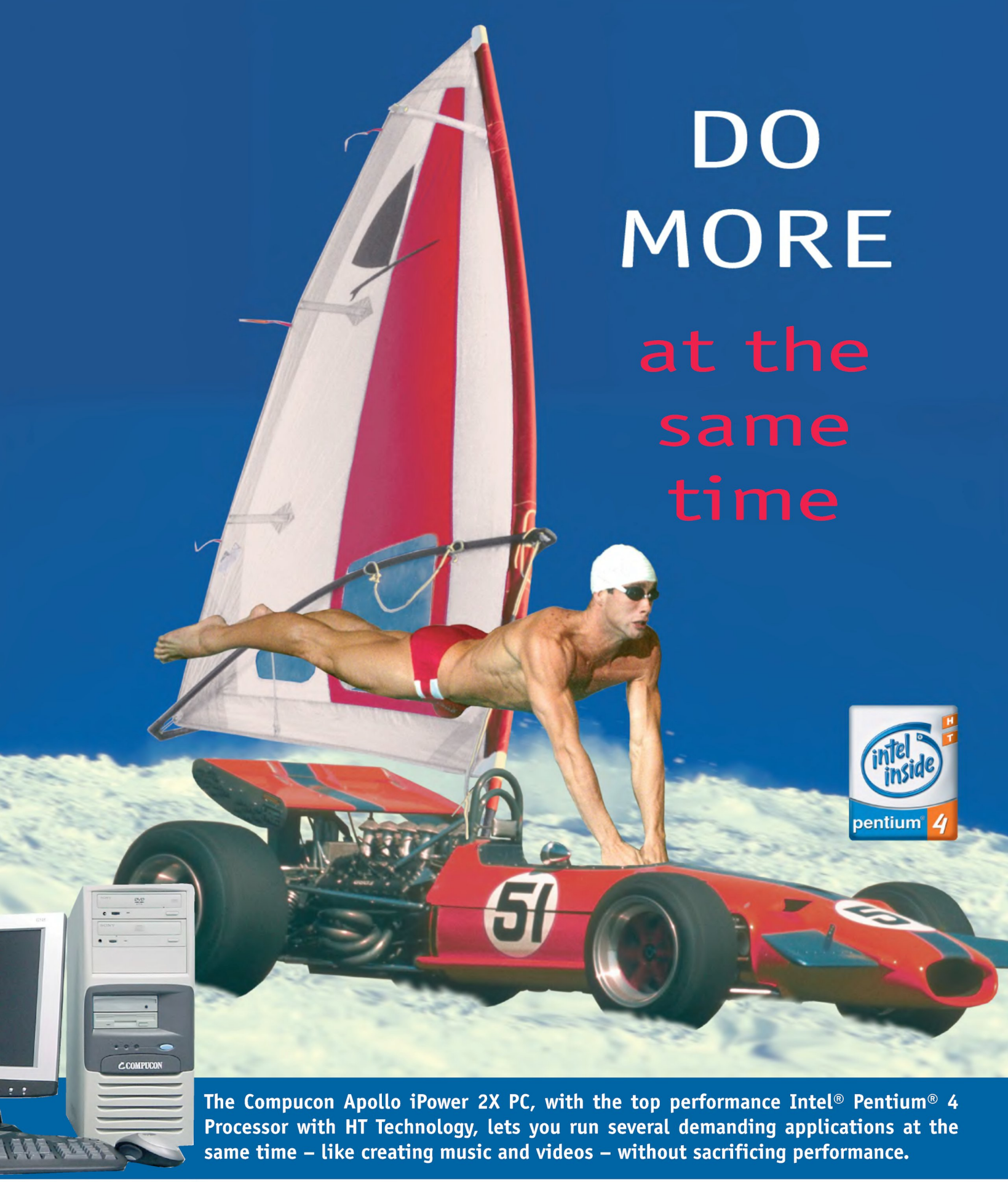
Back in PC-land, a titchy low-noise Micro-ATX box is now a thoroughly sensible choice for a lounge room PC, or for anybody who needs to tote their PC to and from the office or geek gathering regularly. You can throw a good one together for a thousand bucks, sans monitor.

But, of course, you wouldn't catch *me* using something the size of a toaster as my everyday PC. They'd fire me. It's full ATX mobo, funky case, bit of an overclock, build it yourself for me. Naturally. And yes, two grand sounds about right.

If you're part of the population segment that regularly sends letters to their MP complaining about the law that precludes non-cola soft drinks in this country from being caffeinated, thereby forcing you to attempt to recreate the LAN party Mountain Dew/Bawls experience with water, Fruit Tingles and No-Doz, then I'm presuming you'll be with me on this.

"But, of course, you wouldn't catch me using something the size of a toaster as my everyday PC. They'd fire me. It's full ATX mobo, funky case, bit of an overclock, build it yourself for me."

Like pasta? How about the nuclear variety? You won't find it in supermarkets, but you will in supernovae. The high densities in a neutron star creates liquid neutrons. In the process, nuclei produce odd-looking formations that look like pasta. Yummo.



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2003 HOTBOX OF THE YEAR

Those boxes of hotness, and the satisfaction they bring – it's all come to a bright, spinning, fluorescent head. It's the pulsating point of no return, a bubble of pure creative bliss – one that has built up for an entire year. Who will violate this vesicle; this voluptuous vessel of bulging prestige? One of the 48 prized Hot Boxes that grace these biblical pages of creation. And godly they are.

Forty-eight boxes. 48. XLVIII. Honestly, it matters not how you put it. It's a magical number, more magical than Gandalf, his staff and the Magic School Bus combined in one, big, glorious mystical manifestation.

This awesome award is reader's choice – it's always been the way. You send them in, we put them up, and you pass judgment. It's a group activity, and one we heartily enjoy. Heartily and immensely. So, it should come as no surprise that the biggest Hot Box of them all – ever – will be voted for by Atomicans. At least one of these beauts should get the contents of your boxers tingling. If not. . . you should by new boxers. And mod them.

To vote, all you need do is visit www.atomicmpc.com.au/features.asp?f=hb

No trickery – it's the *Atomic* Website. The Hot Box section to be absolutely exact. It'll be packed with a plethora of knacker-quaking, eye-consumable cases and towers – be they transparent, quirky, or milk-crate like.

Not time to sit, stare or drool – voting closes on the 16/7/03, with the winner announced in *Atomic issue 32*. Said winner will, strangely enough, win the $4,495 grand prize, a glorious conglomeration of shiny components to deck out your system, supplied kindly by Compucon (www.compucon.com.au). It's thanks to the Greg and great people at Compucon that we've had prizes – terrific, nicey nice prizes – to give to the best boxes. Cheers to them, and to you.

So go look. Go votify.

HOT BOX 2003

HOTBOX OF THE YEAR GRAND PRIZE. . .

$4,495 worth of bits. The winner's box will obviously be the best in the universal galaxy, so the lucky constructor will bag some digital lifestyle tackle instead, rather than a white box, which would be plain as.

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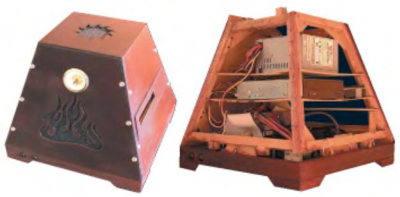

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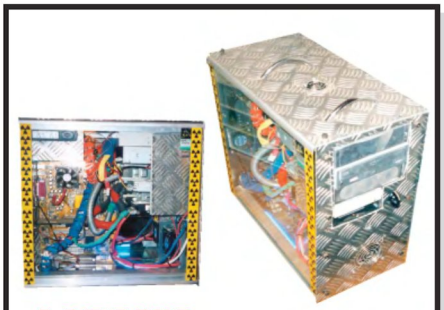

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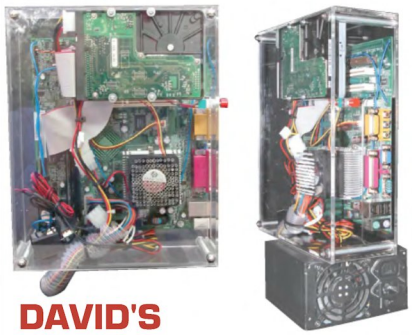
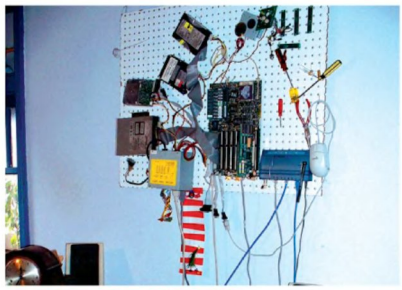


DAVID'S MIDGET



RADAGAST'S RACK

SCARED LITTLE GUY

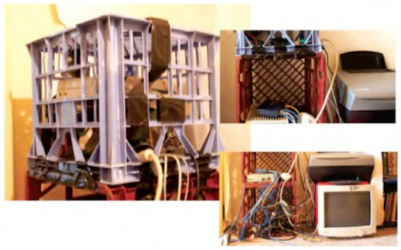
TONY'S YELLOW

THE DOG BOXES

EXPLAGUE'S DANGERBOX

RED RAZOR

KURT'S TRICKEDOUTPC



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ICEMAT mousepad

Supplier: Innovision
Website: www.innovision.com.au
Phone: 1300 785 795
Price: TBC

Hoorah! The time to rejoice is nigh! Finally, a custom, 'too cool for school' mousepad that actually works! This mousepad worked perfectly with our Logitech Dual Optical mouse, but had problems with cheaper optical mice. The pad is constructed entirely from frosted glass, with an incredibly smooth top surface. The result is a sensation that your mouse is sliding over a nice, greasy layer of untainted baby's blood. . . erm. . . melted butter.

Take note – if you don't mount the 'pad surfer' tape included in the kit onto the bottom of your mouse, expect an awful scritchy-scratchy noise that will send you insane in the short time it takes to boot up your PC.

Tweakmonster EL Appliques

Supplier: PC Case Gear
Website: www.pccasegear.com
Phone: (03) 9568 0932
Price: $36

Now this is the kind of product we like to see. Yes, it's yet another glowy gadget, but it's not simply based on ramming LEDs into bits of plastic. It's an appliqué (a fancy pants way for saying sticker) covered in a protective coating of thin transparent plastic. A 12V inverter with a Molex attachment plugs into the base of the appliqué. When this is switched on, the appliqué lights up like, well, like nothing we've ever seen before. It's a bizarre yet cool effect. The only downside is the clunky inverter box, but this can easily be hidden away inside your case.

We have windows; you have windows. A hard fact to deny. If you were to lie about it, it'd be an untruth we'd see straight through. As if the lie were a prism in the sun, we'd split fact from fiction like the colours of the spectrum. Yeah. . . violet for violations, red for reality.
Glass isn't really a solid. Fact. The tiny particles of quartz that make up your average glass window actually 'leak' over time. In old windows it's easy to notice the distortion – they're just wavy patterns that 'run' downward. Is that crystal clear?

Zippy EL-610 keyboard

Supplier: Anyware
Website: www.anyware.com.au
Phone: (07) 3856 3999
Price: $85

Here we go again – more lighty brighty stuff. But like the EL appliqués, this keyboard is actually kind of cool.

It emits a warm blue light, handy during those late night gaming sessions; no longer will you need to keep a lamp on, as you'll now be able to see each and every key perfectly thanks to its self illuminating properties. The effect is very similar to the prissy Neons mounted under the cars in the abortion of a film, *The Fast and The Furious*. Except if you use this keyboard, it doesn't automatically make you a wanker, unlike the Neons seen under the above mentioned cars. It's much smaller than a standard keyboard, but is still very comfortable to use when gaming.

AMD IN A BOX
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Sony Ericsson HBH-60

Supplier: Sony Ericsson
Website: www.sonyericsson.com.au
Phone: 1300 650 050
Price: $380

While it's not quite as cool as the headsets the troops use in the film *Aliens*, as it doesn't have a built-in video camera to send images back to some pussy holed-up in an armoured personnel carrier while all his troops get eaten, there is still something inherently sweet about this Bluetooth headset.

It's probably the fact that it's so bleedin' tiny, easily being one of the smallest Bluetooth headsets on the market. It also happens to be rather comfortable, unlike certain other headsets that double as medieval instruments of torture.

One other thing you might care to know – it's bloody expensive!

Wacom Intuos tablet

Supplier: Video Bytes
Website: www.videobytes.com.au
Phone: (03) 9348 9177
Price: $924

This product is aimed squarely at the designer types, for use when they're not too busy sipping on lattés, discussing the latest art exhibition or getting $200 haircuts. Kind of like *Atomic's* designer, Tim. So we thought we'd get his opinion on this tablet: 'The Wacom Intuos tablet has to be one of the best tools out there to produce high quality graphics intuitively. This particular model comes with advanced pressure sensitivity that recognizes the tilt as well as how hard you push to achieve complex painting effects otherwise impossible with a mouse. It's one funky package that'll cover a wide spectrum of needs, whether it be Photoshop for your design or Deep Paint for your 3D.' Great, thanks Tim.

OCZ 512MB PC-3700 EL DDR-RAM

Supplier: Yen Industries
Website: www.yenindustries.com
Phone: (02) 9703 7640
Price: $345

If you're lucky enough to have a motherboard that will comfortably run memory at 466MHz, you might be having a few problems tracking down memory that is also happy to run at such a ludicrous speed. Enter this wondrous stuff. Yes, it's not cheap, but it's the only memory that you'll find that you can be confident of running at these kinds of speeds. Sadly we didn't have a hardware combination on hand that could run the memory at this speed, but Yen Industries guarantee it will run at 466MHz – provided you use one of the motherboards that OCZ have tested with this memory. Check the full list of compatible motherboards at www.ocztechnology.com.

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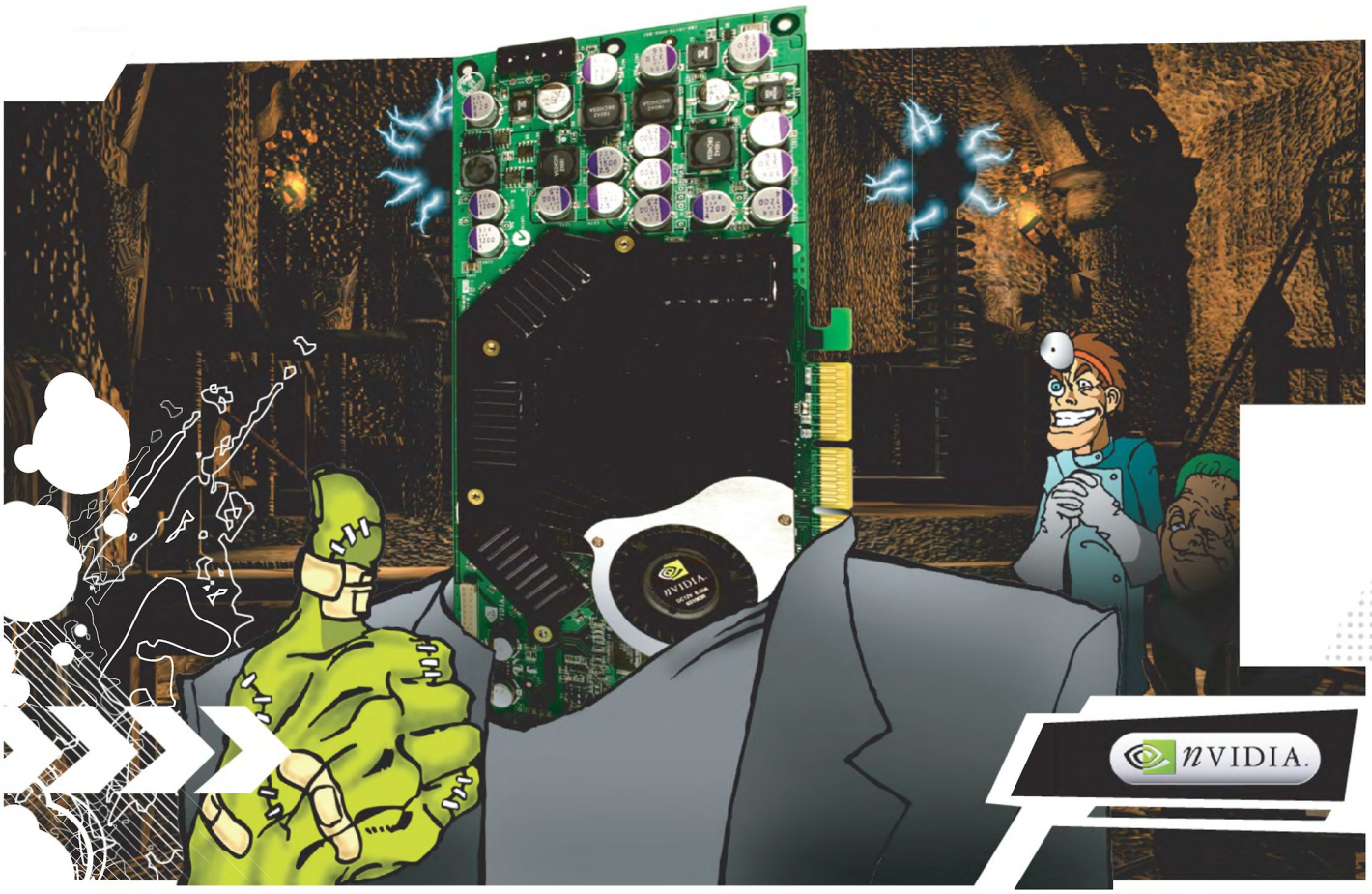

NV35 is alive

The GPU Fantastic! Does it really exist? Every now and then we may think so, but check back six months later and there's always something more light; more fantastic. Another GPU has dawned, and James Wang is here to explain why.

'We screwed up.' That was basically NVIDIA's executive summary on the GeForceFX 5800 Ultra (NV30) during the NV35 launch at E3. For a company with a reputation in PR stunts, such a clear confession is hard to come by. But obviously its intention at E3 wasn't just to admit to the previous failure, but to show the world its weapon of redemption: the GeForceFX 5900 Ultra (NV35).

Competition is good

Looking at the graphics market today, one truly can't help but appreciate the immense benefit of competition. From flagship launch to refresh, this must be NVIDIA's fastest product cycle – all thanks to ATI. Of course there is question of whether the NV30 even counts as a product 'cycle', given how fast it came and went with few boards available in retail channels. Putting the past behind, I'm glad to say that the NV35 is the real deal. Gone is the dust buster, however, the new 'brick-sink' solution still takes two slots. Drivers have matured considerably and overall the whole board resembles more what you can expect to buy, rather than a crude engineering sample.

It is interesting to note that NVIDIA and ATI's fabrication strategy is totally reversed. At the March 2003 Morgan Standley investor briefing, NVIDIA's CEO said its strategy to use 0.13-micron for NV35, but employ 0.15-micron for low-end was 'one of our smartest decisions.' His argument is because the low-end requires larger volumes, employing the cheaper 0.15 production lines will allow it to churn out more chips than if it did on the few 0.13 production lines available. ATI has instead put its flagship product on a mature process while migrating to 0.13 for their RV350 mainstream product. Due to the lower power and smaller die, ATI managed to instantly produce a killer mobile DX9 GPU. Both strategies have been rewarding to their respective companies but if 0.13 yields are as healthy as ATI is claiming, then it is likely to edge out NVIDIA in the mainstream race.

What is a GPU anyway?

Before jumping into the tech, it's important to keep a clear view of how GPUs are evolving. Sure, everyone knows they're now programmable and function more like CPUs, but how does this change the entire paradigm of a 'PC'? Will there be a day when you can buy a GPU in socket form and plug it right next to the CPU with both processors sharing a common pool of high speed memory? Will programmers

eventually have to make a choice on where they want their intensive floating point (decimal) calculations to be done? To answer those questions, let's have a look at how innocent graphics accelerators have evolved into their current monstrous forms.

It all began with drawing pixels. Hardwired circuits were used and that was all they did, draw pixels. 3D graphics weren't too much different. Simply, more specialised hardware blocks were added to fulfil the functions of 3D, such as texturing, filtering and converting 3D to 2D display. The early problems of graphics were specific and hence were resolved with specific hardware.

Fast forward to today, simple and specific graphics problems are all resolved. The problems now are in simulating uncountable amounts of visual phenomenon whose solution under the old paradigm would require infinite hardware blocks. Obviously this is not a solution. By examining many of the 3D problems (reflection, water, shadow) in detail, it just happens that the vast majority of them fall into the category of vector and floating point calculations. Hence the natural solution would be to produce a hardware solution that hosts multiple units dedicated to such operations. Whereas before you can point at one of the Voodoo2's chips and say: 'this chip textures pixels in Tomb Raider,' today you can smash open a GeForceFX and say: 'this block is a vector engine. It can be used to animate vertices, find lighting vectors, or do four pages of my maths homework in parallel.' In a nutshell, today's GPUs have few hardwired parts to solve particular 3D problems. They're simply a specialised math calculator whose pool of resource is specific to the needs of 3D graphics. This is probably the best spiritual description of the NV35.

Refreshing bandwidth

NV35 to NV30 is what the GeForce 2 GTS is to the GeForce 256; it's the refresh product of a new architecture. This is often the best product to buy, having matured on a relatively new manufacturing process with most bugs ironed out. The refresh is almost always more balanced, efficient and cooler. Like the first GeForce, the NV30 suffered a major imbalance from the lack of memory bandwidth; although it sported the fastest memory at launch, the 128-bit memory interface was too narrow to unlock the potential of the chip. The NV35 is given a health boost in bandwidth from its predecessor, leaping from 16GB/s to 27.2GB/s. This is the highest bandwidth for any GPU to date, outstripping its closest competitor by a large margin. To put it all into perspective, an NV35 has the equivalent bandwidth of ten VSA-100 chips or five Voodoo5 boards in parallel!

ATI and NVIDIA have upped their latest flagship products to an insane 256MB of memory. But when you consider that 1,600 x 1,200 with 6x antialiasing uses around 95MB of frame buffer, it doesn't seem too crazy anymore. With vertex data, high resolution textures and longer shader programs all competing for memory; it never hurts to have more. The memory chips on the NV35 also happen to be arranged octagonally, as first seen on the Matrox Parhelia. The symmetry and equidistant spacing between chip and memory using this arrangement provides better signal routing and synchronisation.

NVIDIA has divulged no information on the pipeline organisation of its NV3x series. It is however the general consensus that it has separate execution units for integer, FP16 and FP32 colour formats. The inclusion of the legacy integer format is probably to strengthen workstation performance where dedicated integer hardware has optimal performance. However according to unofficial channels, the integer units have been removed from the NV35. This has made room for great improvements in shader performance which was severely handicapped on the original NV30. Although this still doesn't stand up to NVIDIA's claim of two-fold increase, shader performance is now shoulder to shoulder with the RADEON 9800 PRO (R350).

Squished bugs

The first GeForceFX had a broken anisotropic filter and a sub-par AA algorithm. New drivers have arrived with the NV35 to rectify these problems. Anisotropic filtering has indeed received a face lift; at equivalent settings the results are directly comparable to the R350. Antialiasing however is another matter. While NVIDIA stresses the importance of their colour compression technique, the actual quality of their antialiased samples is not comparable to ATI's. As it stands, NVIDIA's current AA algorithm is pretty much identical to the GeForce4. When we brought this issue to

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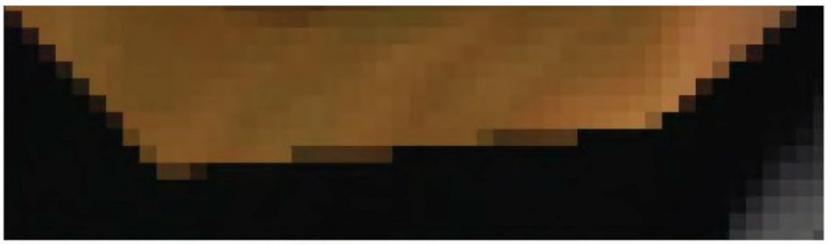
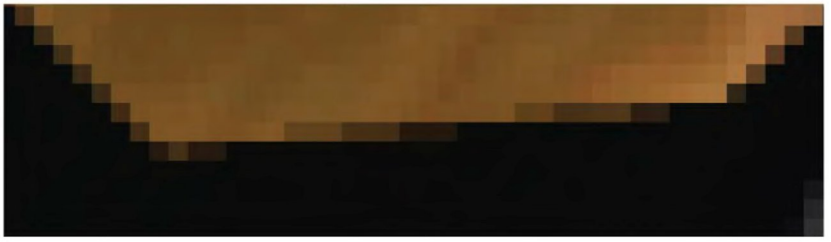


5900 Ultra



9800 Ultra

ABOVE: **The bottom image taken on the R350 exhibits better antialiasing as it has more gradients per line. While the top (NV35) uses a standard ordered grid sampling algorithm, ATI rotates the sample grid then uses a gamma corrected algorithm to produce the final pixels. This gives R300-based cards a smoother appearance for near horizontal and vertical lines.**

their Chief Scientist David Kirk, he emphasised the importance for more real samples over hackery algorithm improvements. Although NV35 can perform eight samples, the end quality is hardly improved from its 6x implementation. ATI's gamma-corrected rotate grid sampling technique is still the best we've seen.

The only new feature introduced to the NV35 is a little something called 'UltraShadow.' This is essentially a shadow optimisation feature for developers using stencil shadows. Just like how bounding boxes are commonly used to test visibility for entire objects at a time, UltraShadow allows developers to create bounding planes that tell the GPU a maximal region that can be affected by a light source and object. As a result, anything outside of this region will summarily ignore shadow calculations, eliminating much unnecessary work. While this feature is very well intended and games such as Doom III are bound to take advantage of it, it only takes care of the stencil method of shadow projection. Shadow maps, which is another popular shadowing algorithm will not benefit as it does not use the stencil buffer. Renderman uses shadow maps for its movies and the screenshots of Half-Life 2 seem to indicate it also uses this technique. Better hardware support for shadow maps will probably not arrive until Carmack bets his next engine on this technology.

Globe-on-chip

As flexible as these new GPUs are, the final method employed to produce images is still the decade-old scanline algorithm. While evolutionary improvements through better shaders are essential, the next big leap is in the realm of lighting. Global illumination is seen by many as the next Holy Grail. It is a way to truly unify our lighting model and remove our current jigsaw of ambient, diffuse and specular models. Without this jump in lighting, our 3D games will forever be viscerally unconvincing. The three most talked about algorithms are ray tracing, radiosity and photon mapping. As they are fundamentally different to how current 3D hardware works, it's only a natural conclusion that only with future hardware support can these new lighting models be realised. But getting back to our pretext that GPUs are no longer hardwired tools to do their intended jobs, but rather a collection of resources suited to 3D calculations, it turns out that these totally unoptimised and alien algorithms for global illumination can be tamed to work inside a GPU.

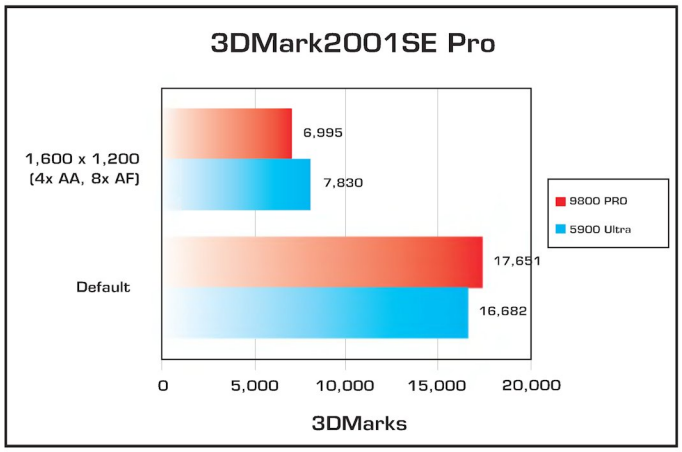
Various academic groups and researchers have published detailed papers on mapping these advanced lighting models to programmable hardware. Some have gone as far as to proposing a brand new hardware architecture for ray tracing. These are highly unlikely to be realised as they can't maintain compatibility with current standards and is essentially starting 3D from scratch.

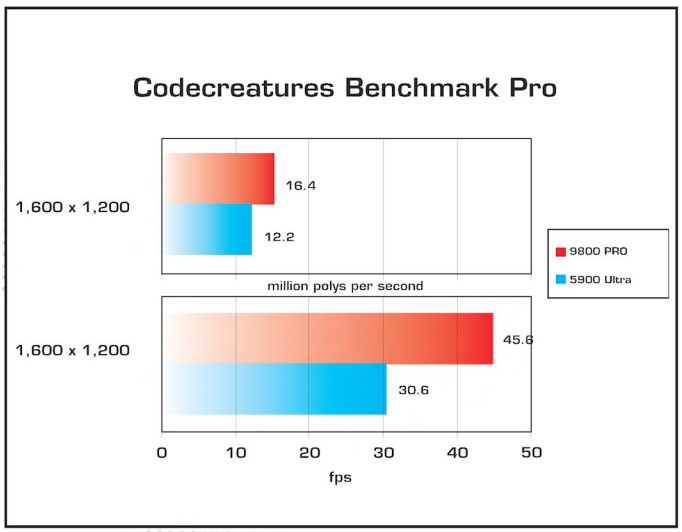
Using the hardware-mapping method, NV35 can simulate low resolution (256 x 256) radiosity lighting at a few seconds per frame. Radiosity lighting allows subtle indirect lighting through multiple light bounces. An example would be a tomato placed on a white table cloth. When rendered using radiosity, it will accurately simulate the emittance of red from the tomato to the table cloth. Famous scenes rendered using this method include the 'IKEA catalog walkthrough' and 'Starbucks trash bin' scenes from Fight Club. While speeds of less than one frame per second are far from realtime, the fact that such implementations can run at all is a major achievement. These capabilities are the clear differentiating factor between semi-programmable DX8 hardware and fully programmable DX9 hardware.

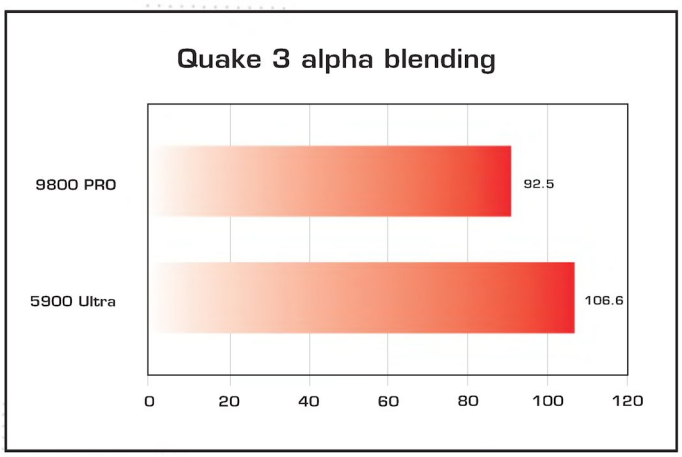
The GeForceFX 5900 Ultra is a fine refresh product. There isn't much point arguing over the picky details between this card and the RADEON 9800 PRO. Architecturally, both have surpassed the fixed functions of previous eras and are flexible to employ algorithms once thought to be strictly for use in render farms. In fact calling them GPUs or VPUs is somewhat of an understatement. 'Stream processor' should be their next name. Given a few more generations down the track, I wouldn't be at all shocked to see a GPU socketed next to a CPU.

Those darn benchmarks

Thanks to the recent controversy with driver cheating in 3DMark03, we've decided to leave it out of our benchmarks for the moment – the new patch from Futuremark that addresses these shenanigans didn't make it in time for our tests. To make sure there weren't cheating mechanisms employed in other applications we made our own demos.







Bennett recorded the UT2003 timedemo with varied gameplay elements. The frame rate average was capture using FRAPS from splash screen to end screen. A custom Quake III demo with heavy emphasis on alpha blending was also recorded.

The initial test involved a default 1,024 x 768 3DMark2001 on a 3.06GHz Pentium 4 system. Both cards scored admirably with the RADEON 9800 PRO taking a 7% lead with 17,651 3DMarks. When maxed out the resolution to 1,600 x 1,200, applied an 8x anisotropic filter and enforced 4x antialiasing the NV35 took the lead by an 11% margin.

Examining the details of the default test, we see that the NV35's strength lies in its multi-texturing and pure T&L (Transform and Lighting) throughput. While the eight-pipelined R350 took a handy 20% lead in single texturing fillrate, in multi-texturing the NV35 wins happily by 10%.

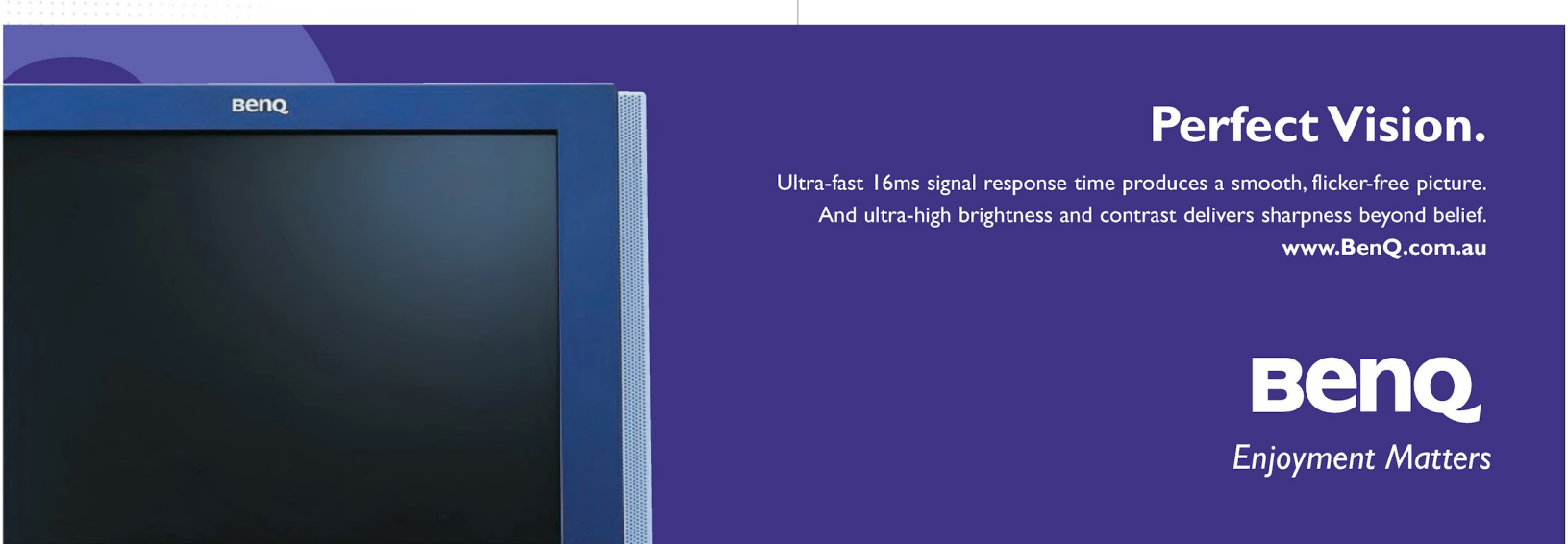
It is also worth noting the inherently more efficient architecture of the single TMU (Texture Mapping Unit) pipelined R350; although the NV35 manages to reach 91% of its theoretical multi-texturing fillrate, the R350 achieves a staggering 98%. Driver optimisation and other factors may also have a part in this. First place for pure polygon pushing power is easily taken by NVIDIA's card – besting the RADEON 9800 PRO by 17% and 47% for single light and eight lights respectively.

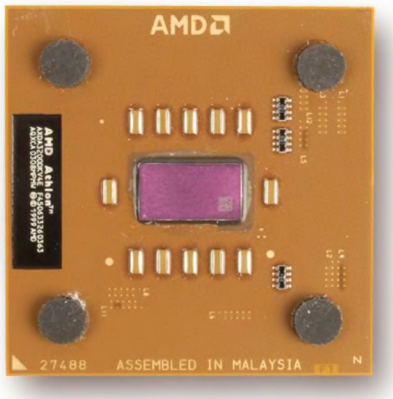
Shader performance is somewhat inconclusive at this stage as NVIDIA's drivers are still taking steps to full maturity; much of their DirectX features are still not enabled. Although they have a highly optimised DOT3 bump-map implementation (the key operation in normal mapping as discussed in this month's Scanner), their general shader performance lagged behind the competition. Vertex shader and pixel shader speed at the default resolution were solidly taken by ATI with a most dramatic lead in the pixel shader 1.4-based 'Advanced Shader Test' by 74%.

Our custom tests involved a FRAPS captured UT2003 game and a gib-fest in Quake 3 Q3DM1. The UT2003 results proved inconclusive as both cards produced around 22fps with a minimum framerate of 15. This is likely to be caused by the heavy bottlenecking produced by the 4xAA and 8x anisotropic filtering. The Quake 3 demo was arranged in Q3DM1 (the smallest map) set with the maximum amount of bots (12 Orbs) at the lowest AI setting. Its focus was to produce as much blood as possible in the narrow corridors. With multiple frags occurring in tight corridors, loads of blood is generated and exceptional stress is placed on the alpha-blending hardware (responsible for fog, CS smoke grenades etc). In this last test, the GeForce scored a generous 106.6fps, a 15% lead over the RADEON at 92.5fps.

Overall we'd say NVIDIA's card has more driver headroom. They're both superb performers; each card delivering 'oomph' in their respective niches.

If you're in a dire need to upgrade, pick one you're comfortable with. But remember, better cards are always on their way.





Hertz to burn: Athlon XP 3200+ vs. Pentium 4

AMD and Intel have recently launched faster frontside bus processors and paired them with dual-channel DDR. John Gillooly discovers what impact this will have on the ongoing performance war.

Atomic has visited the Athlon vs. Pentium 4 battle several times in the past as these CPUs evolved into the beasts they are today. Initially the Willamette Pentium 4 performed at a level much lower than the Thunderbird-cored Athlon, a gap increased by AMD when it released the Palomino and its PR rating scheme for CPU labelling. This was an attempt to blur the boundaries between the high frequency but relatively low performing Pentium 4 architecture, and the more frequency efficient Athlon architecture.

Intel struck back with the Northwood core for the Pentium 4, dropping the die to a 0.13-micron process and upping the L2 cache to 512KB. This allowed the Pentium 4 to leap ahead of the Palomino and following Thoroughbred cores of the Athlon. AMD recently released its Barton core, with the same 0.13-micron process and 512KB of cache that made Northwood so powerful.

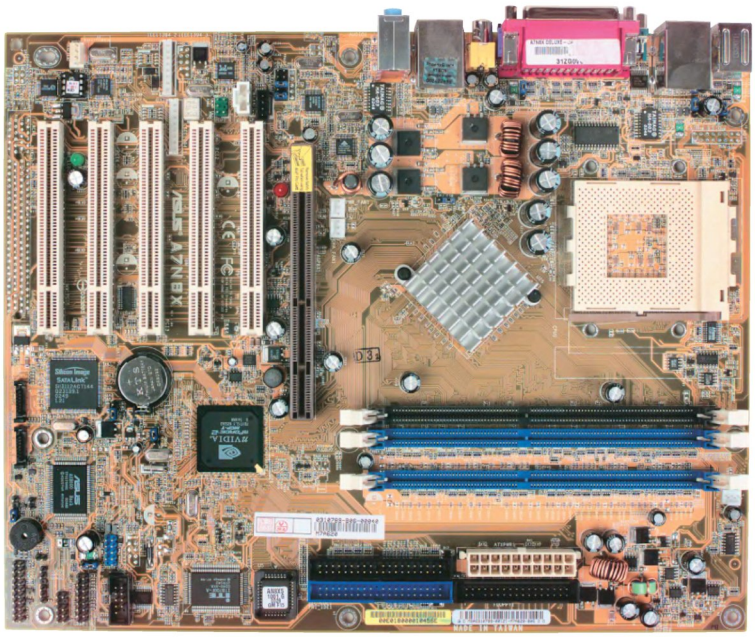
Barton has culminated in a new 400MHz FSB model of Athlon XP, the Athlon XP 3200+, which operates at 2.2GHz. This is set to be the last major core revision before AMD debuts its much delayed Athlon 64 processor later this year. With the release of this chip we have taken the opportunity to get another snapshot of how the performance race between Intel and AMD is going, and see what effect the new generation of dual DDR chipsets has on performance.

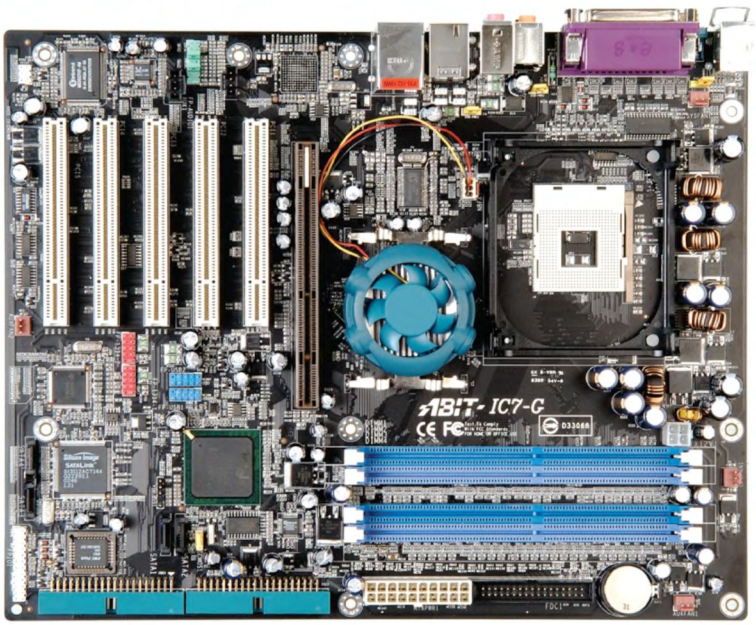
This month's head-to-head is brought to you by dual-channel DDR, feature heavy motherboards and the number 200. Last month Intel introduced a 3GHz Pentium 4 running on a quad-pumped 200MHz bus (800MHz effective), and this month we see the Athlon XP 3200+ that uses a double-pumped 200MHz bus for an effective 400MHz FSB.

This has happened thanks to the gradual legitimising of DDR400, mainly through pressure brought by Intel to get the standard up and running without final JEDEC approval. Normally we would be reticent pushing a semi-official standard, the recent scaling back of 802.11g from 54Mb/s to 20Mb/s being a good example of changes that can occur at the last minute; however the sheer weight of Intel being thrown behind DDR400 means an almost assured success for the standard as it currently stands.

These new CPUs have been performing at their peak thanks to some phenomenally fast chipsets. Intel launched its new flagship performer, the i875P and NVIDIA has launched a new nForce2 variant of sorts, the nForce2 Ultra 400. Both of these chipsets employ dual-channel DDR to maximise their performance, however the theory behind dual-channel DDR varies for each platform.

Intel uses the technology to optimise the bandwidth of the P4's 800MHz bus. Two sticks of DDR400 running in dual-channel mode delivers the 6.4GB/s needed for the P4 to have maximum memory bandwidth.





ABOVE: On top is ASUS' A7N8X Deluxe version 2 motherboard, which is based around NVIDIA's nForce2 Ultra 400 chipset. Below that is ABIT's IC7-G, which uses Intel's i875P chipset.

The Athlon only has 3.2GB/s available bandwidth, which matches up with the 3.2GB/s delivered by a single-channel of DDR400 memory. This begs the question of why bother with dual-channel DDR400 for the Athlon, when a single-channel will deliver all the bandwidth needed?

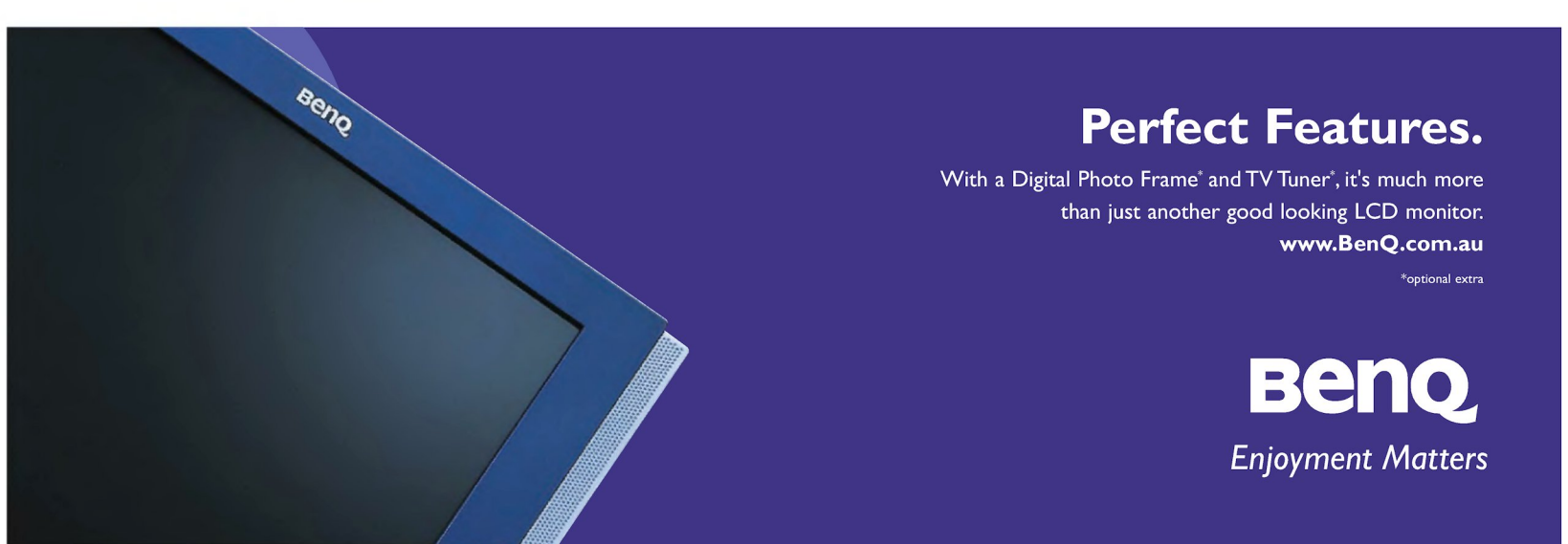
The answer is quite simple; it isn't just the CPU that needs direct memory access these days. Having an excess of memory bandwidth means that operations like texture access over the AGP port, and I/O operations requiring direct memory access will not compete with the CPU for memory resources, making for smoother system performance and higher benchmark results when the program is stressing multiple subsystems.

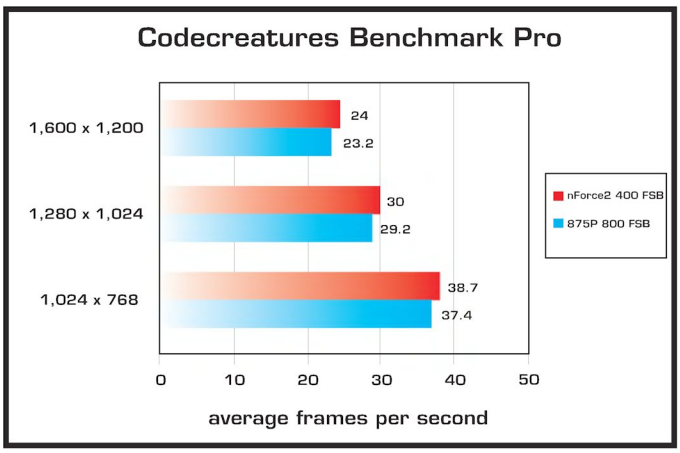
We have taken this into account in our testing. We've benched the 3GHz C model Pentium 4 against the Athlon XP 3200+ using a suite of benchmarks that can be split into two categories. The first is our usual CPU testing suite, and the second is a collection of game and application benchmarks designed to stress the system's memory bandwidth.

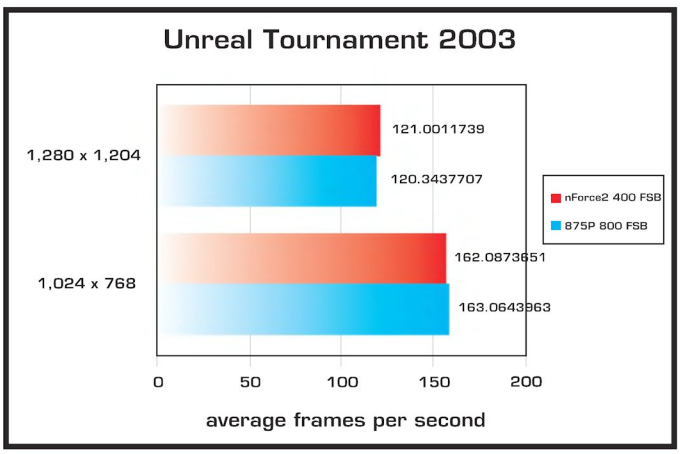
The Pentium 4 has been paired with an ABIT i875P based IC7-G motherboard, two sticks of Kingmax DDR400 and a GeForce FX 5800. For the Athlon XP 3200+ we have used the same RAM and video card, but we have chosen an ASUS A7N8X Deluxe version 2 motherboard based around the nForce2 Ultra 400 chipset.

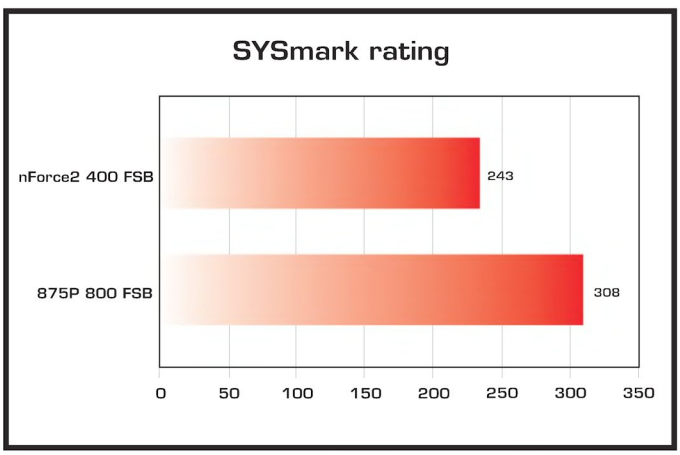
For our CPU testing we have included results from the notoriously Intel-focused SYSmark2002, and the pure bandwidth testing of Quake 3: Arena. The results are included not only for consistency, but also to show that there are factors influencing system performance above and beyond simple CPU grunt. Both of these tests show clear victories for Intel, with a 26% lead over the Athlon XP in SYSmark2002 and an 18% lead in Quake 3: Arena.

However these trends do not carry over into actual system performance. 3DMark2001SE Pro shows the Pentium 4 system coming out 5% faster than the Athlon, which is the biggest lead that Intel has in the









system wide tests. In Unreal Tournament 2003 the Athlon XP is neck and neck with the Pentium 4, a trend repeated in Codecreatures where there is less than a frame difference in each test.

SPECviewperf is a professional graphics benchmark and perhaps the best stressor of all the subsystems. A typical viewperf benchmark run has the graphics hardware, CPU and hard disk working overtime. In viewperf the results between the two test setups are generally consistent except for the vertex-heavy DesignReview viewset test (drv-08), where the Athlon XP leaps ahead.

Again we see despite the marketing and branding shenanigans, and the huge clock speed disparity, there is little overall difference between the high-end products from Intel and AMD. There are still architectural differences, and Intel would argue that the inclusion of Hyper-Threading is a performance booster, even though tangible performance gains are rare with this very young technology.

Intel CPUs will continue to excel at certain benchmarks if

NFORCE2 400 SERIES

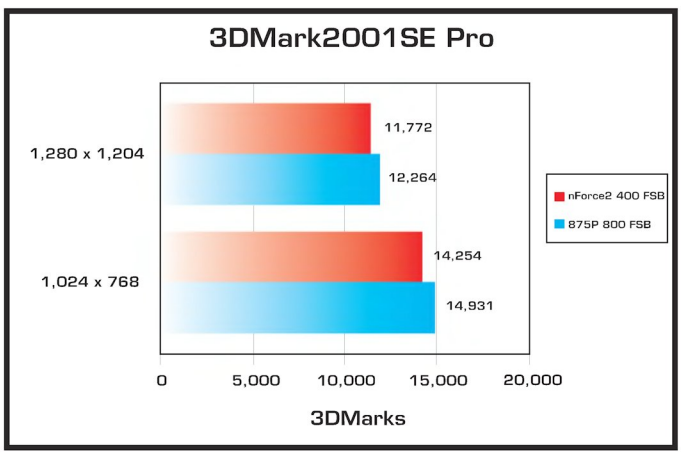
Until recently NVIDIA had two base models of the nForce2 platform processor available, the nForce2 SPP and nForce2 IGP. The major difference between these two chips, which occupy the traditional Northbridge role, is the presence of integrated graphics on the IGP.

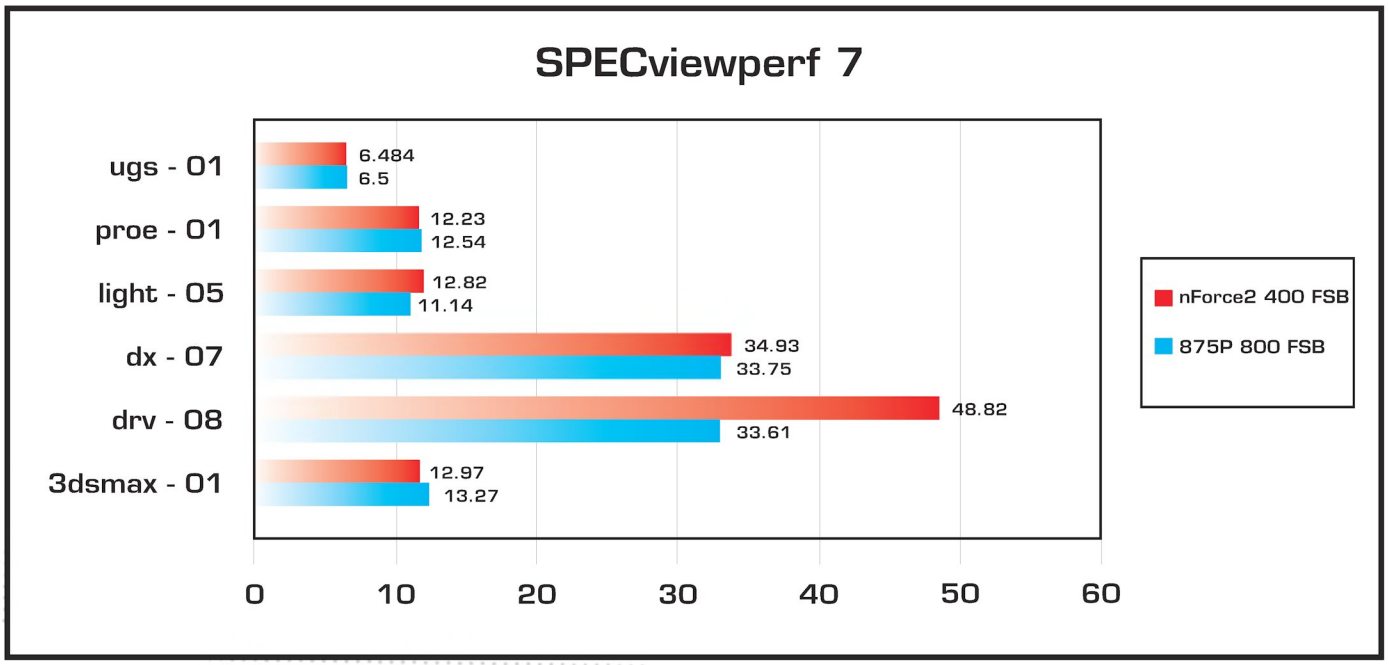
NVIDIA has broadened this range now with the launch of the nForce2 400 and nForce2 Ultra 400. These two models replace the current SPP design and sit alongside the IGP in the new product range.

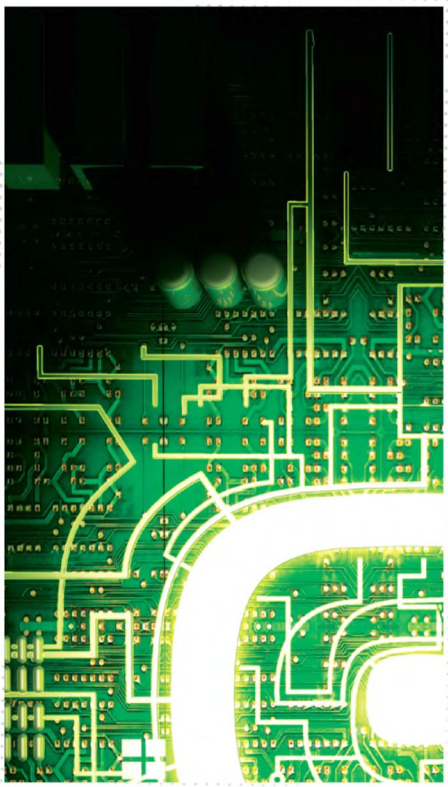
nForce2 400 is a single-channel memory design, using a 64-bit memory controller.

Designed for the mass market, it allows for bandwidth matching between the FSB and memory bus, but lacks the overall enhancements to system performance seen with dual DDR. We are yet to see actual boards, but the nForce2 400 is designed as a mass market solution. Enthusiasts are being pointed towards the nForce2 Ultra 400, which implements NVIDIA's dual DDR technology through a 128-bit dual-channel memory interface. This is the chipset we tested with.

nForce2 Ultra 400 is a tweaked version of the original nForce2 SPP architecture, designed to better accommodate a 400MHz FSB. It has actually been shipping since February and will be detected as the new model name with driver and/or BIOS upgrades of some existing boards.







support is added for SSE2 and/or hyperthreading, while AMD's chips excel at raw CPU intensive operations.

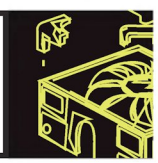
This is why we use a suite of benchmarks to test CPUs and one of the big reasons for excitement about the Athlon 64, which will bring SSE2 to AMDs platform.

However for the moment we have the Barton cored Athlon XP and even without SSE2 raw across-the-board performance gaps between it and the Pentium 4 just do not exist.

In the past the decision between the two CPUs would have been a no-brainer. Historically AMD's top-end CPUs have been much cheaper than Intel's, a major reason for their popularity among price conscious enthusiasts. However we did some searching around on prices, as the US dollar price in one thousand unit lots that is quoted by chip manufacturers is usually irrelevant when it comes to retail pricing. All the prices we saw had the Athlon XP 3200+ sitting at around $900 while the 3GHz C model Pentium 4s were sitting in the low $800 range. Intel has also flowed its 800MHz FSB on to slower processor models, while AMD were yet to have anything other than a 3200+ running on a 400MHz FSB.

Our current tip would be to search out a lower-end D1-stepping Pentium 4 with an 800MHz frontside bus. These low-end models are cheap and are found to be highly overclockable. Until AMD flows the 400MHz FSB down to the lower speed models Intel has the advantage.

The first CPU to use a clock multiplier was Intel's 486DX-2 50MHz CPU. Alongside the DX-2 66MHz and DX-4 100MHz models, this ushered in the era of upping the CPU speed through multipliers rather than raw FSB boosts. Since then we have seen many strategies for squeezing performance out of CPUs. The most recent of which has been Intel's HyperThreading, which is part of a move away from raw Megahertz as a measure of performance. By adding things like HT, companies like Intel can avoid the heat problems inherent in relentless frequency increases.



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Enjoyment Matters

Guide to glowification

You'd think that, with the sun, we'd have all the light in the world. However, our need to illuminate is a strong one, stronger even than the desire to purchase a fluoro lightsaber online. Thank Ra we have Daniel Rutter to show us the light side of lights, so we can get some enlightenment.

Want to light up your case? Want to light up your car? Want to light up your, um, bar fridge?

Can do. There are lots of photon pumps that run from the 12-volt rail in a PC (or in a car). You can get many of them from ordinary computer shops these days.

But exactly what kind of light you should use for a given frivolous purpose depends on what you want to achieve.

Do you want to illuminate a large area – your whole motherboard, say – brightly? Do you want to spotlight one particular component? Do you just want to mark out the edges of something?

Read on to find out which lighting technology is good for what you need.

Incandescent

You're not likely to light up your PC with a tungsten filament globe, but you probably *are* going to light your computer room up this way.

Incandescent bulbs are cheap, last a reasonably long time (generally one to two thousand hours of use), are usefully bright, and give okay yellow-white light with a Colour Rendering Index (CRI) of 100. That means they output all visible light frequencies. No matter what colour something is, an incandescent bulb will provide photons of the right frequency for it to reflect. So you'll see all objects in the room as they actually are, albeit tinted a bit yellow.

Incandescent lamps are a balancing act between efficiency, toughness and longevity. The tubular bulbs in most car interior lights, for instance, last a *really* long time and will put up with a lot of vibration, but when you think about it their efficiency is lousy and they suck a lot more power than you'd expect from their size and their relatively low brightness.

Household incandescent bulbs, in contrast, have better efficiency and medium life, and are quite fragile. But they're certainly cheap.

Regular light bulbs are good for around 15 to 20 lumens per watt of output. The more lumens per watt, the more efficient a light is.

Halogen downlights, (most of which run from 12 volts of zap juice – you can run them from a PC power supply, if you must. . .) although they may look it, aren't that much more efficient than regular nitrogen-filled light bulbs. They manage around 20 to 25 LPW, but their integrated reflectors make appear to look brighter, because they're throwing all of their light in one direction.

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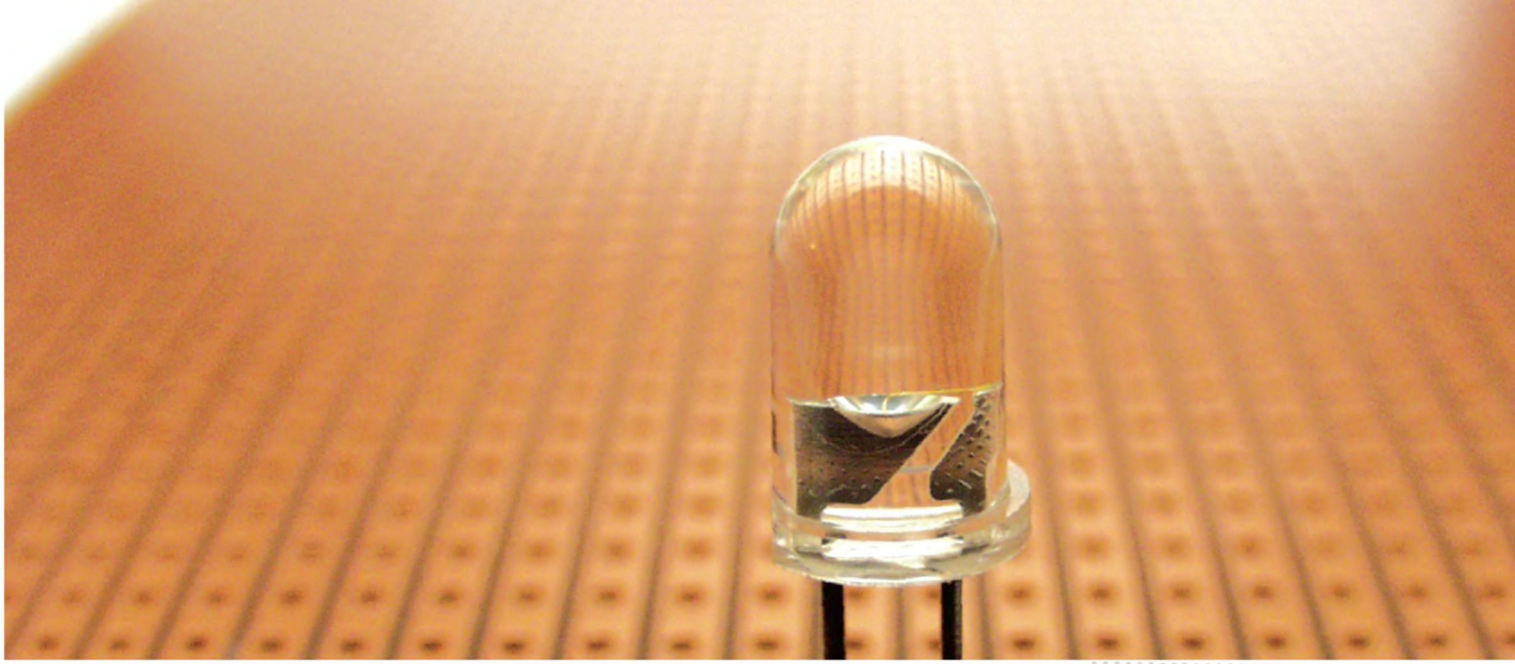
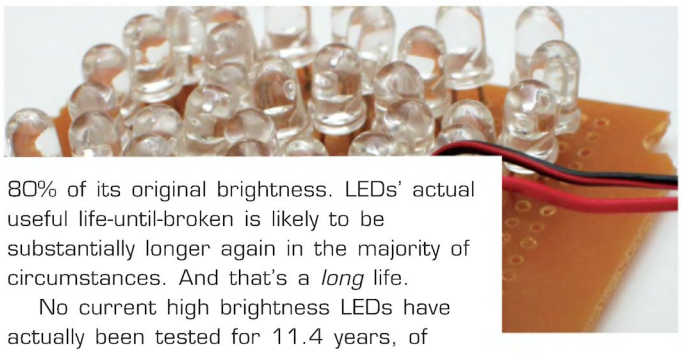


Incandescent globes of any sort are *not* a good choice for coloured lighting. Sticking a high-powered yellowish light behind a filter that eats most of its photons is certainly a cheap way to get every room lit a different colour during your party, but it's very wasteful.

If you *must* put Christmas tree lights in your PC, please use LED ones.

LEDs

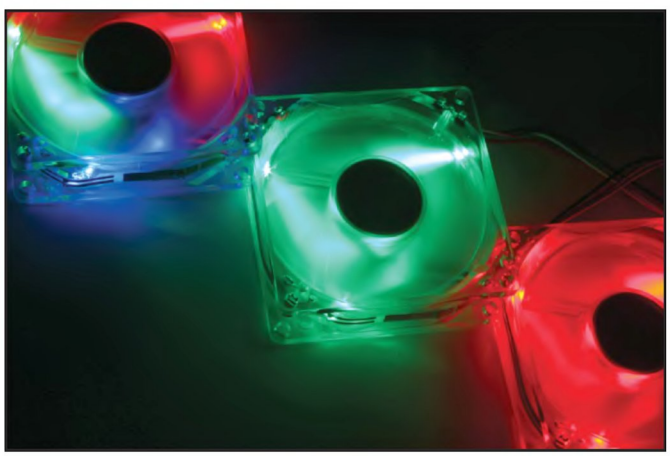
If you don't overdrive an LED, it's likely to run continuously for many tens of thousands of hours without losing much brightness. One hundred thousand hours, or 11.4 years, is a commonly quoted figure before an LED will drop down to



80% of its original brightness. LEDs' actual useful life-until-broken is likely to be substantially longer again in the majority of circumstances. And that's a *long* life.

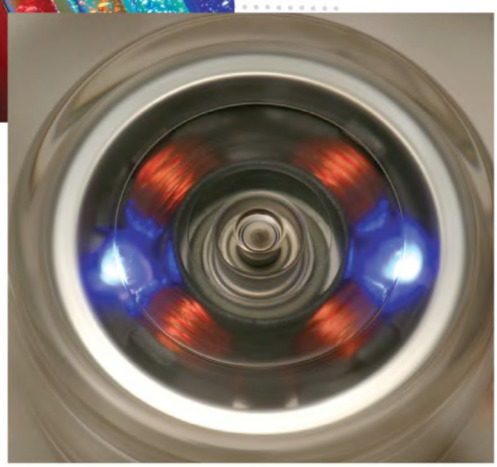
No current high brightness LEDs have actually been tested for 11.4 years, of course. But it's safe to say that a conservatively driven LED *will* last a spectacularly long time.

BELOW: **LEDs work well for lighting up fans.**



LEFT: **'Bubble lights' use a single LED at the end of a bubbly stick of acrylic. Magical, honestly.**

BELOW: **LEDs are small enough that they can fit into the motor assembly of a fan! Look at the spinny lights!**



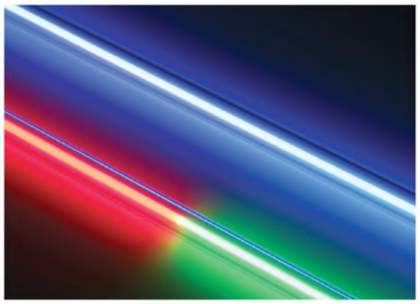
If you're looking for a gnarly lighting technology you can pass on to your grandkids, this is the one.

Coloured LEDs – which are the ones you're most likely to use for decorative purposes – aren't quite as efficient. Not incredibly so, but they manage from about 20 to more than 50 lumens per watt, depending on the colour and how hard they're driven. Efficiency will oviously drop the harder you drive them, and many high-scoring LEDs' rated current is well above the current at which their efficiency peaks.

Coloured LEDs, though, have a CRI of zero. They only emit one frequency, so everything they light up appears in shades of that one colour.

Most decorative LED products consume a trivially small amount of power, by the standards of a normal PC PSU, but they also don't output a ton of light. A few standard 5mm LEDs won't be enough to light up a whole case. They'll do great for spotlighting your CPU cooler, though!

White LEDs, on the other hand, aren't likely to be any



ABOVE: **You can get CCFLs with one, two or three colours of phosphor coating all on the one tube.**

more efficient than a halogen downlight. They'll consume a lot less power, but they'll put out a lot less light too; the ratio of power to light will be about the same.

The reason why white LEDs are less efficient is that they're actually blue LEDs, with a phosphor coating over the 'die' that emits the blue light. The phosphor absorbs some of the blue light and emits red and green light to fill out the white spectrum. It's a long way from 100% efficient though, so white LEDs come in at around 15 to 25 lumens per watt.

Most current white LEDs emit blue-white light with a CRI of 85 or better; that's good enough for practically any purpose, including lighting your fine art prints.

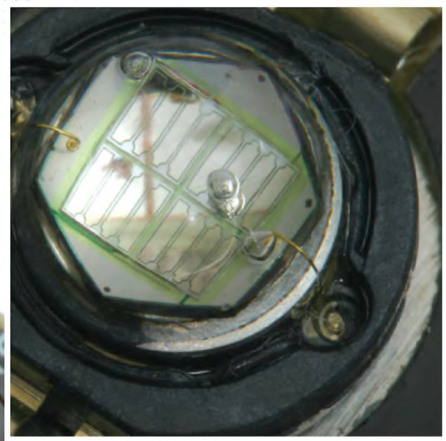
To get a lot of light out of LEDs – like, enough to brightly light the whole of the inside of your PC's case – you either need a lot of LEDs, or you need a few really *big* LEDs.

Luxeon Star LEDs from Lumileds (www.lumileds.com) are the most powerful LEDs on the market at the moment. With a heatsink stuck to them, the top-of-range five-watt Luxeons can easily output 50 times as much light as a standard 5mm 'high intensity' LED. Two or three of the cheaper one-watt Stars make a nifty caselight, as seen in the project in *issue 12* of *Atomic*. Unfortunately, nobody seems to sell pre-built caselights using Luxeon LEDs, and the bare LEDs aren't easy to find in Australia. Try Prime Electronics (www.prime-electronics.com.au).

Fluorescent

If you want really efficient household electric lighting, fluorescent is your only option. It's streets ahead of anything else. Ordinary household fluoros – straight tubes and Compact Fluorescent Lamps (CFLs) – manage 60 to 80 lumens per watt. That's three to four times as efficient as a normal light bulb. Fluoros last about ten times as long as incandescent bulbs, too.

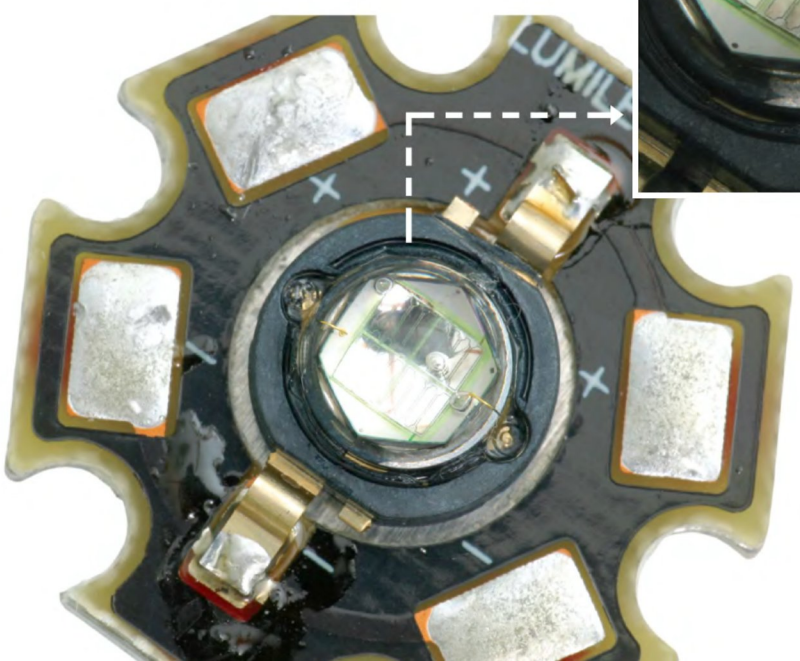
White fluoros' CRI is around 60 to 90; different phosphor blends on the inside of the tube (the phosphor converts the hard ultraviolet output of the energised mercury vapour inside to visible light) give different frequency balances.



Generally speaking, the better the efficiency, the lousier the colour rendering will be; if you can't tell your pink jelly beans from your orange jelly beans, you're probably sitting in a very efficiently lit room.

The bright and inexpensive Cold Cathode Fluorescent Lamps (CCFLs) that many case modders and car decorators love so much are quite different from regular household fluoros.

On the plus side, they come in lots of nifty colours (including "blacklight" near-UV models), and can be found in short lengths that fit in a computer case. The biggest CCFL you're likely to see in a case mod store is 300mm long, but there are versions down to 100mm, not to mention round CCFLs that fit nicely



NEWSFLASH: COMPUTER GEEKS STILL PALE!

Ultraviolet light, in general, is bad. It's what gives you sunburn and skin cancer. Ultraviolet light from 'blacklight' fluorescent tubes, though, is harmless. It's long-wavelength 'UVA', quite close to visible light. The UVA waveband is about 400 to 315 nanometres (nm), but blacklight tubes only emit light at the longer end of it.

Tanning-bed UV lights deliver short-wavelength UVA, which is more dangerous. Actual sunlight also contains just a little bit of UVB light, 315 to 280nm, which will tan you fast. UVB is what the ozone layer blocks. Then there's even shorter wavelength UVC, which is blocked by oxygen and nitrogen in the air, and a good thing too. UVC is what'll burn the corneas of your eyes if you try arc welding without proper protective gear.

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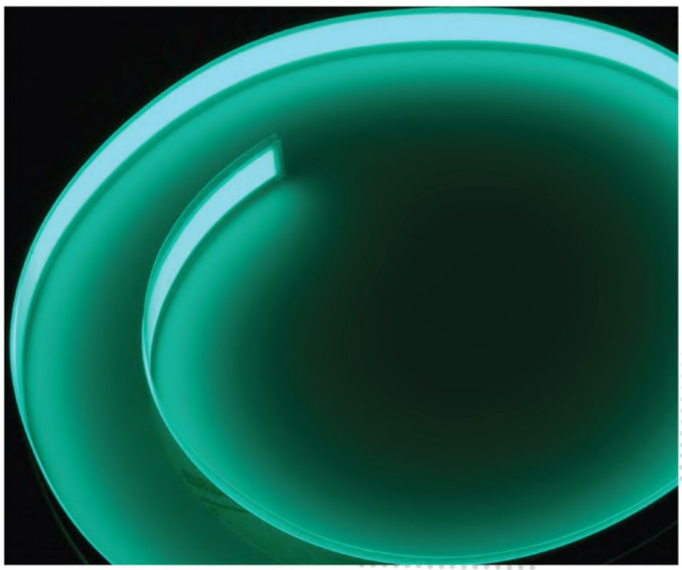


ABOVE: You can attach either EL strip or wire to just about anything you want to, be it computer, couch or cat.

GETTING A TINGLE

PC-decorating lights are not an electrocution hazard, unless you try really hard.

LED lights of all kinds run from low voltage direct current (DC). The 12-volt rail of a computer PSU is enough to run a few LEDs in series; LED lights may run from a little black box that looks like a CCFL inverter, but the power supply section doesn't have to be anything more than a resistor in the supply cable.

If you strip some wires and dangle them on your motherboard, you could toast your motherboard with an LED lighting product. But you won't zot *yourself*, unless you attach the supply wires to needles and jam them into your chest. The same thing goes for all of the normal outputs from your PSU.

Electroluminescent material runs from around 120 volts alternating current (AC), oscillating at some fairly low frequency – often only 60Hz. 120VAC is a very effective human-killer, but only if it's coming from something with a bit of current capacity. Fortunately, the current capacity of small EL light inverters is very low, so you won't feel more than a slight tingle from them unless, once again, you break the skin.

CCFLs run from several hundred volts AC, oscillating at tens of kilohertz. This high frequency high voltage will strike little buzzy sparks onto your fingers if you're klutzing around with a CCFL inverter when it's powered up. This will sting a bit, but it isn't particularly dangerous. It isn't kind to the inverter, though. So if you want to impress girls, we suggest you stick to crushing beer cans on your forehead.

Thomas Edison invented the bulb of light back in 1879. And while these globes of gold emit alot of light, they also generate a frick load of heat. Light bulbs are about 10% efficient – that's a huge waste of electricity, coal, nuclear fuel and heavy water. How dense is that?

behind fans.

CCFLs are, however, not nearly as efficient as household fluoro tubes. The lumens per watt scores of 300mm CCFLs are down around 20 to 30, and shorter tubes are even worse. You could possibly light a whole room with them, but you'll need several.

If you only want to light up the inside of your PC case, though, a *single* 300mm CCFL may well be too bright. Two should make your decorations very easily visible indeed. But those two six-to-seven-watt tubes will still not be putting out a great deal more light than the bulb in your fridge.

Electroluminescent

If you want to outline something with light, rather than shine a light *onto* it, then electroluminescent (EL) tape or wire is for you.

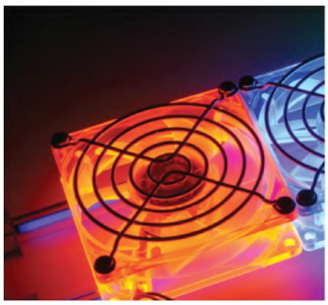
EL material is dim; it's used for backlights on wristwatches and mobile phones, and that's about as bright as it gets. It's also inefficient; you'll be lucky to get ten lumens per watt, and you may only get six, especially if you've got EL material that's been tinted to a colour far away from its natural blue-green hue (which means a CRI of zero, again).

EL material also has a lousy lifespan. After one year of on-time, it's going to be a lot less bright than it was when new.

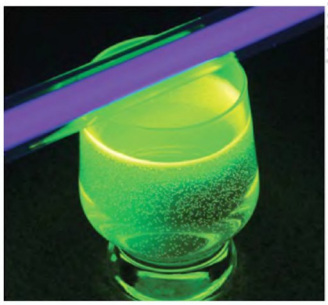
But you can get EL material in self-adhesive strips or super-flexible wire, and you can cut it to length and warm it with a hair dryer to get it to bend around tight corners, and it's not terribly expensive.

If you want a bright light, don't get EL wire, tape, sheet or anything else. You'll be disappointed. For accent lighting, though, EL does tricks that nothing else can do.

Ultraviolet fluorescent tubes are useful for making other things glow. . . red, blue, or reblue.



Like these UV-reactive fans, as an example. . .



. . .or this coolant dye. . .

. . .or just tonic water. It's your choice of mixer really.

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DEVELOPER DILEMMA

one game, four platforms. . .

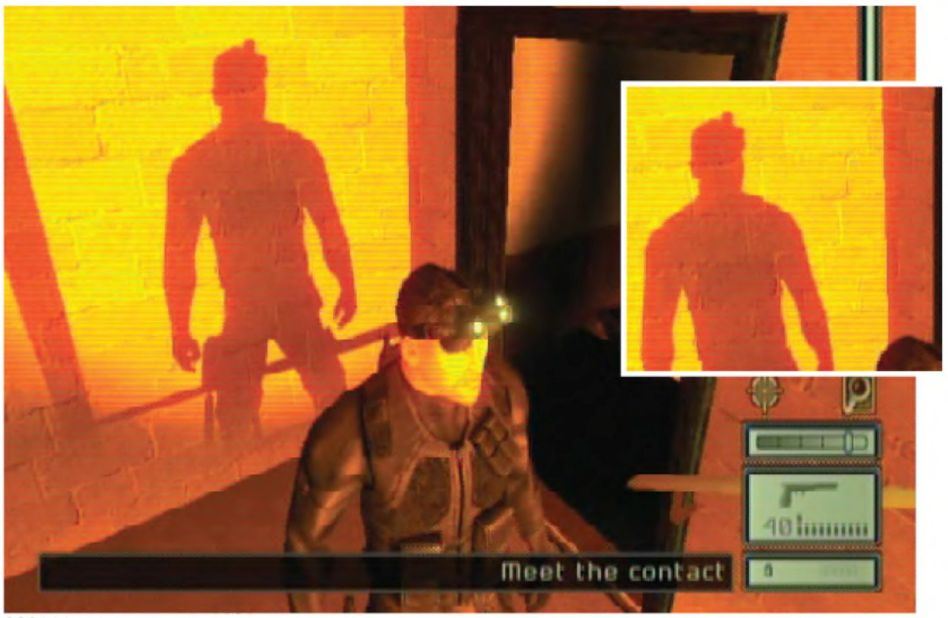
Ever wondered what game developers think of the major gaming platforms? Bennett Ring put this question to the makers of Splinter Cell, for a guts and all look at the PC, PS2, GameCube and Xbox.

We've been meaning to put all of today's major gaming platforms up against each other for a while now. Then along came Splinter Cell, a blockbuster of a game that was released on the Xbox, PC, PS2 and GameCube. What better way to highlight the strengths and weaknesses of each of the platforms than to look at the different ports of this game to see exactly how the versions differ?

The following sections were written by various developers involved in the creation of Splinter Cell. As such, it's the most candid explanation of each platform's pros and cons you're likely to have seen. Huge thanks to Ubi Soft for its assistance, not to mention honesty, with this article. Now, let's see what a team of real developers have to say about the four major gaming platforms. . .

Thanks to Danny LePage (3D Programmer, Splinter Cell; Lead Programmer, Splinter Cell 2); Shen Li (Lead Programmer PS2 and GameCube ports); Wang Yang Jun (Lead Programmer GameCube port); Francis Coldeboeuf (GameCube text) and Carol Bertrand (Technical Director, Splinter Cell 2).

BELOW: **Along with the PC version, the Xbox does an impressive job rendering Splinter Cell. Although the trusty IBM compatible is much more pretty, the NV2A can't be faulted.**



Xbox

The original Xbox version was developed over two years by a team of eight programmers, thirty artists and level designers, two producers and two associate-producers. As with any core game design, most of the time was spent experimenting with game concepts and algorithms and it took a while before everything was put together. It was only after E3 2002 that everyone started working together in the same direction; the market had undoubtedly tagged the E3 demo as amazing.

From a technology perspective, the key point of the project was when Lead Programmer Antoine Dodens decided to develop only for Xbox, dumping any algorithms that might end up not working with other consoles – or even the PC. Specific Direct3D Xbox extensions were used, making the game incompatible with non-NVIDIA graphic cards. Some of these algorithms couldn't even run on a PC because Direct3D wasn't exposing the necessary features required.

This allowed the team to create a game with a unique look using most of the Xbox's features, and also helped to speed up the development of the title. Much of the work was in fact accomplished in the last six months before the game shipped. Due to this approach, it was thought for a while that the game would end up being non-portable to the PS2. The Xbox has a very feature-rich GPU compared with the PS2, as well as a much more powerful general purpose CPU. On the other hand, the vertex shader unit isn't as flexible as the PS2's VUs. This partly explains why skinning was done in software, as the Xbox vertex shaders can't output vertices to memory. The key elements of the Xbox version are the use of pixel shaders for all of the special effects including the glow, the night vision algorithm, the thermal vision algorithm and the shadow buffer algorithm unique to Xbox and NV2x/3x cards. The decision to use this algorithm was pivotal in the look and feel of this version of Splinter Cell.

The Xbox doesn't really have any weaknesses, so to speak, with a very well balanced design. The CPU is great, the triangle processing power is very powerful, the raw pixel power is strong, and the overall graphics/audio features are great. While 64MB of memory isn't much, it's still better than all of the other consoles, though it's still not much compared to the PC. The Xbox's hard drive is a great tool to stream data from – something the other consoles don't have. In all, the Xbox is an excellent platform and the other platforms can be judged positively or negatively relative to it.

Xbox unique features include a depth of field effect when using the sniper zoom. The Xbox also has great sound because of its powerful APU. Only PCs with nForce/nForce2 motherboards are able to achieve the same level of sound rendering. Sound Blaster Live! is getting very old these days, and it certainly shows with Splinter Cell.

The Xbox version makes extensive use of the Xbox's hardware, using features such as the stencil buffer, pixels shaders, vertex shaders, SSE optimisations and hard drive sound streaming.

TOP: **Splinter Cell's fire effects.**

ABOVE: **Like the Xbox, the PC uses a shadow buffer to generate convincing realtime shadows.**

PC

The PC version went gold on January 23, four and a half months after the port started. The main challenge was to make it compatible with older generation DX7 graphic cards like the GeForce2 GTS. These cards don't support the basic algorithm to render shadows on Xbox (shadow maps) and they don't have pixel/vertex shaders. ATI's cards, such as the 8500 or even the newer 9700, even if they did support pixel/vertex shaders, can't do D3DFMT_D24 depth textures. The team consisted of three programmers and one intern (two 3D programmers helped finish the version late in the project). Four artists were also on the project, as well as one producer and one associate producer.

Replacing the shadow buffer algorithm was no small task; it involved finding a replacement algorithm that was able to be used in the current scenes without too much artistic work. We decided to use the shadow projector algorithm because, as with shadow maps, it was possible to use an object's alpha texture to update (or not to update) the depth or color texture target.

As for key differences compared to the Xbox version; the NVIDIA NV2x/NV3x doesn't have the same depth of field when using the sniper rifle and gun muzzle flashes only generate dynamic light illumination for a single frame; however, the night vision post-filter is much clearer than on Xbox and it supports higher resolutions.

The PC version has three render paths; the one for NV2x/3x cards is very similar to the Xbox (almost identical except what is described above). Here are the special characteristics of each adaptor class.

Class 2 graphic adaptors (NV2x/NV3x):
Dynamic lighting system: shadow buffer
Vertex position modifiers: yes
Light beams stopped by depth texturing: yes
Pixel shader effects/filters/water: yes
Reflection/details texturing/specular: yes

Class 1 graphic adaptors (R2xx/R3xx/Parhelia):
Dynamic lighting system: shadow projector
Vertex position modifiers: no
Light beams stopped by depth texturing: no
Pixel shader effects/filters/water: yes
Reflection/details texturing/specular: yes

Class 0 graphic adaptors (R1xx/NV1x)
Dynamic lighting system: shadow projector
Vertex position modifiers: no
Light beams stopped by depth texturing: no
Pixel shader effects/filters/water: no
Reflection/details texturing/specular: no

Xbox has a very powerful graphic chip, but it only renders at 640 x 480. On PC, one of the main considerations was that the graphics chip is often less powerful, yet users have access to higher resolutions.

PCs also have faster CPUs and much more memory. The tradeoff was to reduce the graphic load and increase the CPU/memory load to make the game playable on PCs with GF2 GTS cards. In that respect, the shadows are not rendered every frame in the shadow projector version to reduce graphic processing. This takes a lot of memory – no less than 38 texture render targets are used for static/dynamic shadows (cache).

Finally, the control had to be adapted. It turned out that the mouse/keyboard combo was almost perfectly adapted to Splinter Cell. Aiming became much easier and we had to reduce Sam's hit point in the PC version. Jumping was a little harder but still far from difficult (precision was slightly lost in Sam's movement because of the use of keyboard keys).

The levels of the Xbox and PC version are exactly the same. The only difference is the visibility system when you are playing on a RADEON card versus an NVIDIA card. The light sources are different and the enemies won't notice you at the exact same point. We tried matching the lighting/visibility as much as possible.

PS2

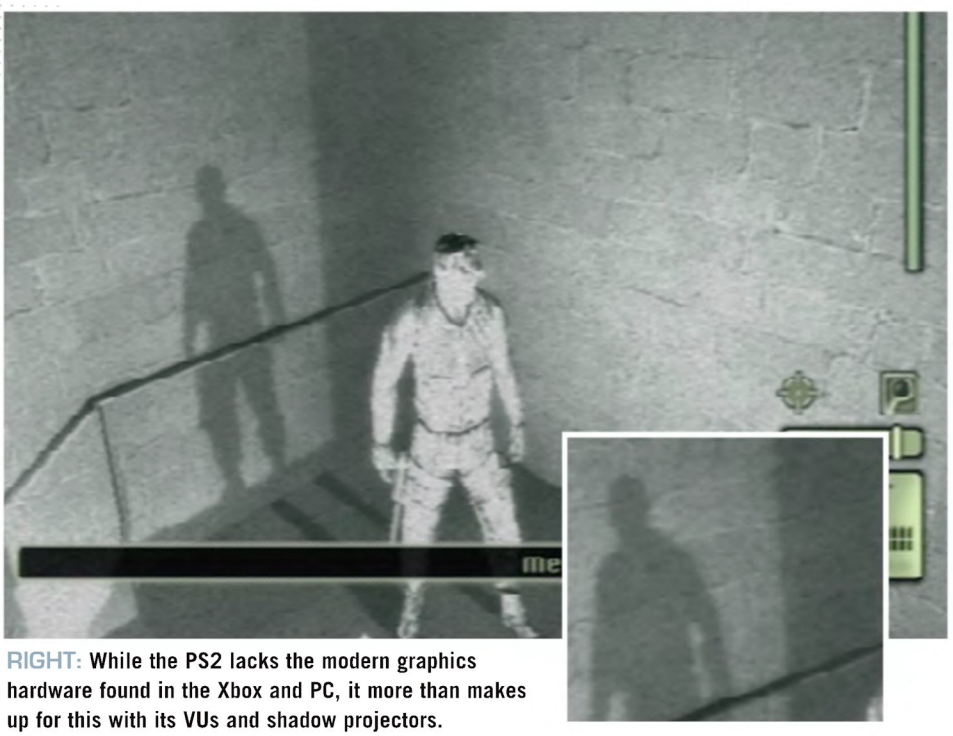
The PS2 port was completed by Ubi Soft's Shanghai team, and it turned out to be a huge task. Several staff from Ubi Soft Montreal moved to Shanghai for months to help them optimise the engine and reorganise the levels. Imagine having to port an engine that was written for the PC (where memory is not a limit) on to the tiny 32MB of memory on the PS2. Fortunately the Shanghai team is very experienced with the PS2 and was able to optimise the code better than any other Ubi Soft design centre.

The main advantages of the PS2 compared to the other consoles is the power and flexibility of its two vector units and its huge fill rate (16 pixels/clock x 150MHz, for fill rate of 2.4 gigapixels per second on bilinear-filtered samples; the Xbox only has four pixels/clock x 233MHz, for fill rate of 0.933 gigapixels per second on bilinear-filtered samples – or 1.866 gigatexels per second when dual-texturing is used). The Shanghai team took every possible advantage, maximising this strength.

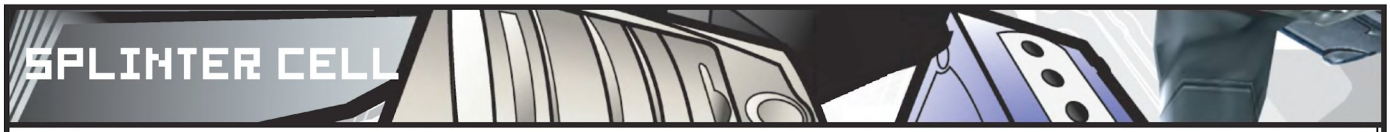
For starters, they moved the skinning from the CPU to the VUs to reduce the load on the CPU (the PS2 general purpose CPU is much slower than the Xbox's PIII CPU). Then they created a shadow projector algorithm specially tailored for the PS2 graphic architecture. Projected shadows required rendering a color mask (single texture) and the PS2 is simply the best for this kind of operation. This means the shadows are just as sharp as the shadow buffers on the Xbox version and much sharper than the projected shadows on PCs. The Shanghai team also added exclusive content to the PS2 version and a few neat features like heat distortion and realtime mirror reflection. They also considerably improved the control over that of the Xbox version.

On the down side, the levels were considerably shortened and only included half the number of enemies/non-player characters as the Xbox/PC version. Sound is obviously not up to the Xbox or even the PC level because of lower sampling rates and reduced overall quality (no EAX, crappy reverb, no 3D positioning). Textures are also scaled down a lot, with detail texturing totally removed.

Finally, there aren't as many lights casting shadows in the PS2 version when compared to the Xbox/PC version. The frame rate gets a little lower than the Xbox version on average but is still reasonable. The AI had to be optimised a lot (visibility ray-casting was very expensive on Xbox/PC).



RIGHT: **While the PS2 lacks the modern graphics hardware found in the Xbox and PC, it more than makes up for this with its VUs and shadow projectors.**



	Xbox	PC	PS2	GameCube
Number of poly's Sam's model	3,200	3,200	2,000	2,000
Average number of polygons in NPCs	2,250	2,250	1,300	1,300
Lighting technique	HW dynamic/ projected textures, lightmaps, light beams	HW dynamic/ projected textures, lightmaps, light beams	VU1 lighting, projected textures, lightmaps, light beams	Hardware lighting, projected textures, lightmaps
Max texture resolution	512 x 512	512 x 512	256 x 256	256 x 256
Resolution	640 x 480 (480 progressive scan	1,600 x 1,200	640 x 448 (NTSC) 512 x 512 (PAL)	640 x 448 (NTSC) 512 x 512 (PAL)
Shadow technique	Shadow maps	Shadow buffers/ shadow projectos	Projected shadows	Projected shadows
Antialiasing	NO	NO	NO	NO
Dynamic LOD	Pre-build LOD only for characters	Pre-build LOD only for characters	Pre-build LOD only for characters	Pre-build LOD only for characters
Anisotropic filtering	NO	Supported (driver setting dependent)	NO	NO
Bump-mapping	NO	NO	NO	NO
In-game sound	4.0 outupt encoded in real time into Dolby Digital 5.1, 64 hardware voices	4.0 output, 16-32 hardware voices max depending on hardware	Dolby PLII, 48 hardware voices	Dolby PLII, 48 hardware voices
Average texture size per level (MB)	8	8	3.5	3.5
Max number of hardware lights per mesh	5	5	4	4

GameCube

Taking about eight months to complete, the GameCube port is very similar to the PS2, and the main difference with the other platforms lies in the level design, which was reworked for two reasons: to make the game a little easier, following feedback from players, and to fit the levels into the memory of the console. But beside these changes, the goal was to provide the same gameplay experience across platforms – the differences reside more in techniques and hopefully are not too obvious to the player.

We improved the water effect on GameCube with a realtime deformation of the background. Lighting techniques are also different from the Xbox game as the GameCube version uses projected lights instead of shadow buffers. We also benefited from the hardware support for lighting on the GameCube. We added some new effects too (heat effect, mirrors and reflection on glossy surfaces). But the GBA link compatibility is probably what makes the GameCube version really different from the others. The top view radar is a very useful tool when you want to avoid trouble. And the sticky bomb appears to be a very effective spy tool. Last but not least, you'll also notice that the control scheme on GameCube is very different from other platforms. The GameCube controller needs a specific approach as it has less buttons, very different ergonomics, and GameCube players have different habits. So we had to completely rethink the controls for it.

The GameCube has a real issue with size: the size of its main memory (24MB), the size of its memory card (512KB) or the size of its mini-disc (1.3GB). During the whole production, we've been struggling for extra space here and there, squeezing everything or using compression. We even had to write our own memory management system in order to save space and benefit from the extra 16MB of 'sound memory'. The rendering pipeline, with the embedded frame buffer, also cost us extra efforts to achieve some specific special effects. The texture formats supported by the GameCube also appears to be an issue when you are using a lot of transparency and alpha channels. But beside this, the GameCube is a very easy to deal with console.

Its main processor is very fast, which gives the GameCube version the highest frame rate of all the platforms. The hardware support for lighting is obviously a key feature for Splinter Cell on this platform. The S3TC hardware support for textures is a very effective space saver without sacrificing quality. The hardware support for indirect textures is another key feature that helps when creating new effects that would otherwise require a pixel shader. We've used indirect textures for water, mirror, heat effect, snake camera, sniper view, and for the shockwave effect of the sticky bomb. And finally, when testing and debugging, the use of cartridges instead of discs unexpectedly proved to be an advantage.

A perfect performer?

As you can see, there isn't really a clear cut winner out of all of the platforms, although it does appear that the PC and Xbox have the greatest advantages. But then again, the PS2 seems to have the edge when it comes to fill rate, while the GameCube shines at hardware lighting. I guess the final verdict comes down to you, the reader, after you've had a look at each of the screenshots, and figured the price of each platform into the equation. After doing so, you'd be hard pressed not to take a liking to Microsoft's powerful Xbox.

HANDS ON TIME:

Now you've heard how the developers feel about creating Splinter Cell on all of these very different platforms, you probably want to know how the strengths and weaknesses of each translates into the gaming experience.

PC

The best looking version of the bunch, PC benefits greatly by the ability to run at higher resolutions. We ran Splinter Cell on a fairly low-end system (3GHz P4, RADEON 9800 PRO – yes that was a joke) and set the game to run at 1,600 x 1,200 with 16x quality anisotropic filtering. Even at these high settings Splinter Cell managed to maintain a playable frame rate. An unexpected side effect of the high resolution is that textures seemed fairly low resolution when compared to other PC titles. The ability to use a mouse and keyboard also makes the PC version the most accurate when it comes to control.

PS2

It's quite obvious that the PS2 is struggling to carry the load of Splinter Cell. Lots of texture shimmering (a trademark PS2 problem), lower detail environments and a juddery frame rate relegate the PS2 version to the worst of the lot. It's not that much worse than the GameCube version, but compared to the Xbox it's light years behind. However, the PS2's unique heat haze effect is pretty cool, which should make the Sony fans a little happier.

GameCube

Considering that the hardware within the GameCube is rumored to cost a mere US$20, we were most impressed with Splinter Cell on Nintendo's little purple lunch box. Especially notable were the light sourcing effects, with many pretty glowy bits and shadows that didn't seem to incur much of a performance hit. However, when it comes to poly counts, the GameCube was in the same league as the PS2 – chewing Xbox dust.

Xbox

If you want to play Splinter Cell on a console, Xbox is the platform for you. Maintaining all of the graphical splendor of the PC version, with high polygon counts and the best lighting and shadowing, its only concession is a lower resolution. Yet even this isn't such a bad thing, as it hides the fact that the textures aren't extremely high resolution. While the developers claim the controls were tightened up for the PS2 version, we didn't notice any difference between the different platforms.

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Doomed to fail

Benchmarking. . . with Doom III Alpha? You must have dead mullets on your brain to pay heed to them says Bennett Ring.

There is no denying that Doom III is going to be one of the biggest titles of the year when it comes to driving hardware upgrades. NVIDIA knows this and, according to them (at least), have built the NV35 from the ground up to perform well in Doom III. Thanks to NVIDIA's partnership with id, it has had much closer access to the code in Doom III than ATI. Not helped by the fact that an ATI employee is rumored to be the source of the Doom III Alpha leaked late last year. This close partnership has resulted in one of the cheapest PR stunts witnessed over the last few years. Here's the deal. . .

Around 12 May, several of the most reputable hardware sites ran benchmarks of Doom III, including [H]ardlOCP and Anandtech. It was rather funny seeing many of these sites claim they had the exclusive story, while four or five other Websites ran the exact same story at the exact same time. Nice exclusive guys.

In every one of these performance previews, the RADEON 9800 PRO was pitted against NVIDIA's NV35. And in nearly every test, the NV35 gave the 9800 PRO a hard smack to the gob. Sounds all good so far doesn't it, allowing gamers to decide which video card to purchase? However, after digging a little deeper, many people soon whiffed the unmistakable stench of marketing manure.

The sites all readily admitted the test was set up by NVIDIA and id. They all had access to the Doom III benchmark for one day in the presence of an NVIDIA representative. Most of the benchmarks were run on machines supplied by NVIDIA. It appears that at no stage was ATI consulted about the tests. Benchmarks that were run on the latest ATI CATALYST 3.4 drivers returned results fixed at 10fps, regardless of resolution or image quality, so most sites reverted back to the 3.2 CATALYST drivers. This should have been warning enough that ATI's drivers simply weren't ready for Doom III for all but the biggest 'NVIDIots'. And why should the ATI drivers be ready – this game isn't due for release for another six months or so, and ATI don't have access to the latest Doom III code thanks to the NVIDIA/id deal.

Yet every site posted the shocking results of the RADEON 9800 PRO. Sure, they also put a paragraph in the intro about how it had been set up by NVIDIA and not to take the results as gospel, but that isn't what people will notice – it's the benchmark graphs that will be remembered.

I wouldn't be so angry if the results of the NVIDIA hardware were published alone, but the inclusion of the ATI results has made me question the objectivity of some of the sites that I used to respect.

I asked Charming Hsu, Senior Sales Marketing Manager at ATI, her thoughts about this marketing ploy. She summed it up nicely in four words: 'The results are meaningless'. Charming went on to say 'Our policy is to focus on benefits to gamers by optimising performance for titles that are actually available. Our drivers will be fully optimised for the release of Doom III, but not before . . . ATI's scores will greatly improve when the game is actually released.'

NVIDIA was also asked to comment on these benchmark results, we also questioned them about how much merit we should take from a test ATI had no access to. Hazel Heng, the Asia-Pacific Marketing Manager for NVIDIA, replied with an astonishing comment 'NVIDIA works with developers early as part of the "The Way It Is Meant to be Played" program, so we can work with developers to ensure a great out of the box game experience. I guess by admission ATI cannot and has to try and spin drivers after games have shipped and end users get less than satisfactory experience.' Try telling that to the million or so satisfied owners of the 9700 PRO. She summed it all up by claiming 'Bottom line, why GFFX 5900 Ultra beats a RADEON 9800 PRO, is that we've architected the FX architecture for next generation games like Doom III and ATI hasn't. We're just faster, plain and simple.' At no time did NVIDIA acknowledge that ATI's drivers simply did not work correctly in Doom III.

I'm sad to say it, but it appears NVIDIA has turned to questionable marketing tactics, instead of continuing to release innovative and powerful products. It's even sadder to see so many review icons suckered into this, all for a fake exclusive. Even John Carmack at id should be hanging his head in shame for endorsing this rubbish. Let this be a lesson to us all – never trust a benchmark that is being controlled by the manufacturer.

On a different note, it's time to bid you all farewell. This is my last issue at *Atomic*, so I'd like to thank you for coming along on the wild ride that has been my time at this amazing magazine. Working at *Atomic* has been a life-changing experience, and it's something I'll never forget. So, goodbye, and I'll see you all in the zone.

GunSling3r, over and out.

artomic

'Bringing on the future' by Philip MacLaren 'Philby'

'Bringing on the future' was created in a three-step process. Firstly, geometric shapes and colour gradients were assembled in Photoshop. Then the image was divided into pieces and exported into 3D Studio Max 3.1. Different sections were then extruded and textured from the original 2D piece.

The 3D model was then rendered and brought into Photoshop for the final stage. The 3D render was then composited and the background created using lines, text and complex masking; all created on the following system: Athlon XP 1800+; 1GB PC2100 RAM; Graphire Wacom Tablet; Photoshop 6; 3D Studio Max 3.1.

Create the winning Artomic and win the latest version of Photoshop Elements and Photoshop Album from Adobe! Email a preview (no larger than 5MB) of your games or hardware-themed masterpiece to artomic@atomicmpc.com.au.

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Benchmarks

At *Atomic*, it is our primary intention to give you the final word on the latest in hardware and PC technology. An integral part of determining the performance of a particular piece of hardware is benchmarking, and this is something that we take very seriously in the *Atomic* Labs.

SYSmark2002

SYSmark2002 is a product of the collaboration between industry group BAPCo (www.bapco.com) and MadOnion.com (www.madonion.com). It is one of the next-generation application benchmarks and is designed to more accurately replicate the day-to-day workload that a system is subjected to. The focus of the benchmark is on Internet Content Creation and Office Productivity tasks, which combine to produce a final performance rating.

Unreal Tournament 2003

UT2K3 is the latest and greatest first person shooter from Epic. The game makes use of the new Unreal Warfare engine, and as such is a perfect benchmark for system performance. We use HardOCP's (www.hardocp.com) benchmarking utility to run a series of flyby benchmarks at varying resolutions to test performance. The utility also features support for a low resolution/high geometry CPU test. Results are in average frames per second.

3DMark2001SE Pro

3DMark2001SE Pro from MadOnion.com is the next progression of the popular benchmark utility. It also uses the MAX-FX engine and heavily emphasises DirectX 8.1 functions, including programmable shaders. The results are not comparable with results from 3DMark2000 Pro.

Serious Sam: SE

Serious Sam: The Second Encounter is used for testing OpenGL performance. For game tests we use the Cooperative demo, which outputs an average framerate trimmed of excessive peaks. It also contains a fillrate test, which outputs fillrates for various texturing methods and is useful for making comparisons between video chipsets.

HSF testing – Chernobyl

To test heatsink fans we use our custom engineered CPU replicator, known as Chernobyl. This beastie pumps a variable wattage through a solid Copper CPU die replica, with a temperature probe mounted in the exact centre of the die replica. Chernobyl results are not directly comparable with real world temperatures, but do provide a very accurate benchmark.

Quake 3: Arena *AtomicMPC* demo

Quake 3: Arena (Q3A), from id Software, is a very popular first person shooter, and represents widely used OpenGL gaming technology. Q3A has a built-in benchmarking utility and built-in demos that can test graphics card performance. These demos are fairly simplistic, so we developed our own *AtomicMPC* demo that pushes the hardware as far as possible.

Other benchmarks

Sometimes we need to break down the tests into more specific areas, such as hard disk performance, memory performance, or a particular facet of 3D, such as T&L. We can draw on a vast number of applications, games and dedicated benchmarks such as CD Speed 99, DisplayMate, Dronez, MDK2, or Adaptec ThreadMark to perform these tests. We also use a Lian Li temperature probe from Anyware (www.anyware.com.au) for tests that involve the measurement of temperatures, such as HDD heatsinks.

Atomic Hot Award

The *Atomic* HOT award is given only to the most kickarse products to hit the Labs, ones that score 9 or greater.

ATOMIC TESTBENCH SPECS

Both test systems use Windows XP Professional with Service Pack 1, DirectX 8.1 and the latest chipset and video drivers.

- **AMD Athlon XP 1800+ system – ASUS A7V266-E motherboard (supplied by CASSA:** www.cassa.com.au)
- **Intel Pentium 4 2GHz – ABIT BD7II-RAID motherboard (supplied by ABIT:** www.abit.com.tw)

Common components

- **Corsair TwinX XMS3200 matched dual-channel DDR-RAM (supplied by Altech** www.altech.com.au)
- **Hercules Prophet II GTS 32MB (supplied by Guillemot:** http://au.hercules.com)
- **64MB Apacer memory keys (supplied by Anyware:** www.anyware.com.au)
- **Hercules Prophet II GTS 32MB (Supplied by Guillemot:** www.hercules.com)
- **Sound Blaster Live! Player (Supplied by Creative Labs Australia:** www.creaf.com)
- **ASUS 52x CD-ROM (supplied by CASSA)**
- **Belkin PCI FireWire card (supplied by Belkin:** www.belkin.com.au)
- **Belkin PCI USB 2.0 card (supplied by Belkin)**

BENCHMARK SETTINGS

3DMark2001SE Pro

- **1,024 x 768; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,024 x 768; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**
- **1,600 x 1,200; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,600 x 1,200; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**

Quake 3: Arena *AtomicMPC* Demo

All tests use Quake 3: Arena 1.27g and our custom Q3A demo recorded by the *Atomic* staff.

- **CPU testing: 320 x 240; maximum geometry detail; minimum graphics settings; high sound quality.**
- **Graphics cards: Low quality – 1,024 x 768; normal quality graphics settings; sound disabled.**
- **Medium – 1,280 x 1,024; maximum graphics settings; with all game sound disabled.**
- **High – 1,600 x 1,200; maximum graphics settings; with all game sound disabled.**

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www.hercules.com

News, Forum, Driver Updates, Product Info...

Framerate

Driver fight! Buying a new video card just got a little more confusing, thanks to NVIDIA's 3DMark03 shenanigans. ATI hasn't been completely static either, and while NVIDIA's been clipping planes, it's had a play with some pixel shaders.

Hercules 3D Prophet 9800 PRO

SPECIFICATIONS: ATI RADEON 9800 PRO; 128MB 256-bit DDR-RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 380MHz **MEMORY SPEED:** 680MHz **PRICE:** $999
WEBSITE: Hercules www.hercules.com
SUPPLIER: Guillemot www.hercules.com

Hercules' entry into the ever-growing RADEON 9800 PRO market stands out from the rest through the use of its own blue PCB and Copper heatsinks. The main cooler has an inoffensive blue glow to it, refreshing after the flashing lights we've seen on other products. One of the big selling points of this card is the inclusion of the just released, and very cool, Rainbow Six 3: Raven Shield game.

S-Media RADEON 9800 PRO

SPECIFICATIONS: ATI RADEON 9800 PRO; 128MB 256-bit DDR-RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 380MHz **MEMORY SPEED:** 680MHz **PRICE:** TBA
WEBSITE: S-Media www.s-media.com.tw
SUPPLIER: Blue Chip Infotech www.bluechipit.com.au

There are a heck of a lot of RADEON 9800 PRO cards out there, which is a huge benefit for us end users. And it's all thanks to the unabashed joy of competitive pricing. S-Media is a low profile company that delivers a great performing card able to keep pace with the fastest of the big guns.

Gigabyte RADEON 9800 PRO

SPECIFICATIONS: ATI RADEON 9800 PRO; 128MB 256-bit DDR-RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 380MHz **MEMORY SPEED:** 600MHz **PRICE:** $1,170
WEBSITE: Gigabyte www.gigabyte.com.tw
SUPPLIER: Synnex www.synnex.com.au

Gigabyte has become one of the main suppliers of ATI-based video hardware in only a short period of time; it's RADEON 9800 PRO is a great performer and we were initially disheartened by the high price tag. However, as we saw with the RADEON 9700 series the price should rapidly drop to sane levels.

MSI FX5600-VTDR128

SPECIFICATIONS: NVIDIA GeForce FX 5600 GPU; 128MB 128-bit DDR-RAM; dual 400MHz RAMDACs; TV-out; VIVO functions; IR remote control.
CORE SPEED: 325MHz **MEMORY SPEED:** 550MHz **PRICE:** $396
WEBSITE: MSI www.msi.com.tw
SUPPLIER: MSI www.msicomputer.com.au

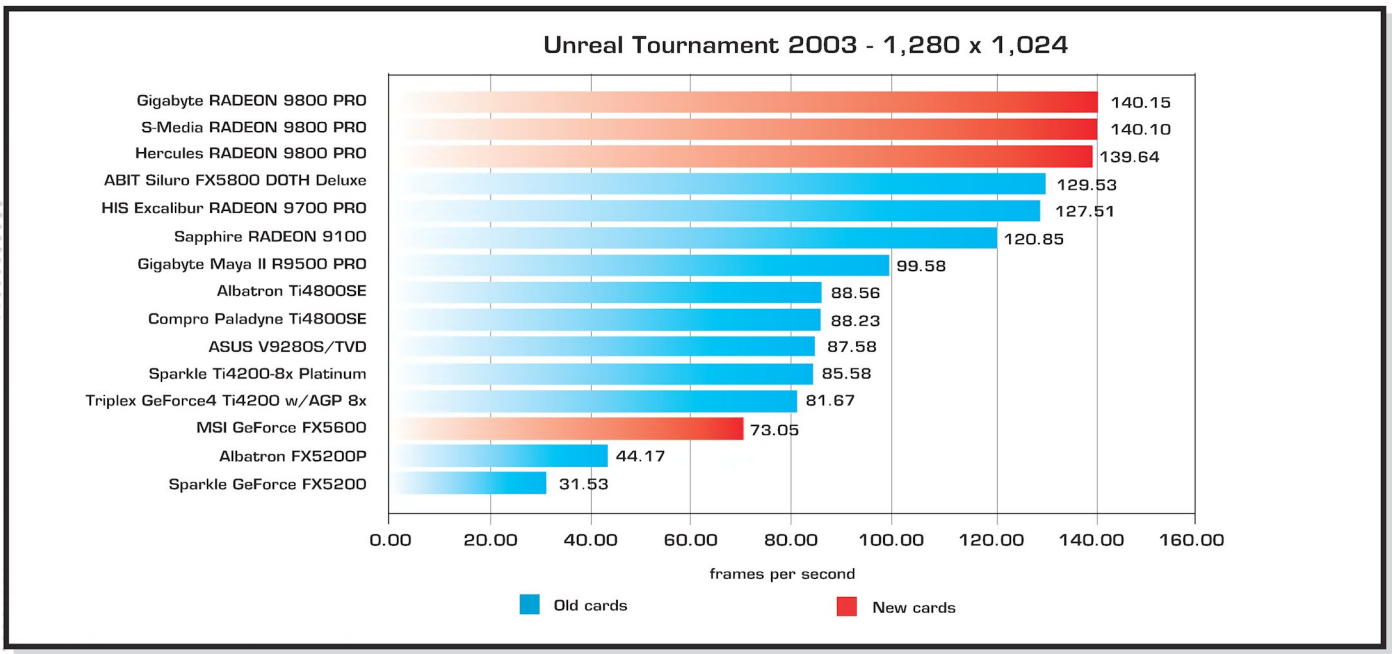
MSI is the first to supply us with a GeForce FX 5600 card, and the performance is decidedly average. With reports of further delays of the Ultra version of this card, we anxiously wait to see whether NVIDIA can repeat the success of the GeForce4 Ti4200. . . which it won't with this setup. It must be noted that this card was not tested with the new Detonator FX drivers.

Video cards

The steady march of DirectX 9 releases continues in the light of the most graphics-heavy E3 yet run. This year's exhibition had ATI and NVIDIA carrying out their battle for hearts and minds from opposite ends of the main hall, and the sheer number of games with funky lighting and shiny water point towards an impending explosion in games using advanced pixel shaders.

Most of these games ran on the GeForce FX 5900, the card NVIDIA sees as its saviour after the less than glowing reception that the GeForce FX 5800 Ultra received from enthusiasts. Besides this launch, ATI's RADEON 9600 card finally seems ready to enter the mainstream, which will increase competition in the realm currently dominated by NVIDIA's GeForce4 Ti4200 range of cards.

As a side note we have put the use of NVIDIA's Detonator FX and ATI's CATALYST 3.4 drivers on hold until a solution is found to the 3DMark03 optimisation issues

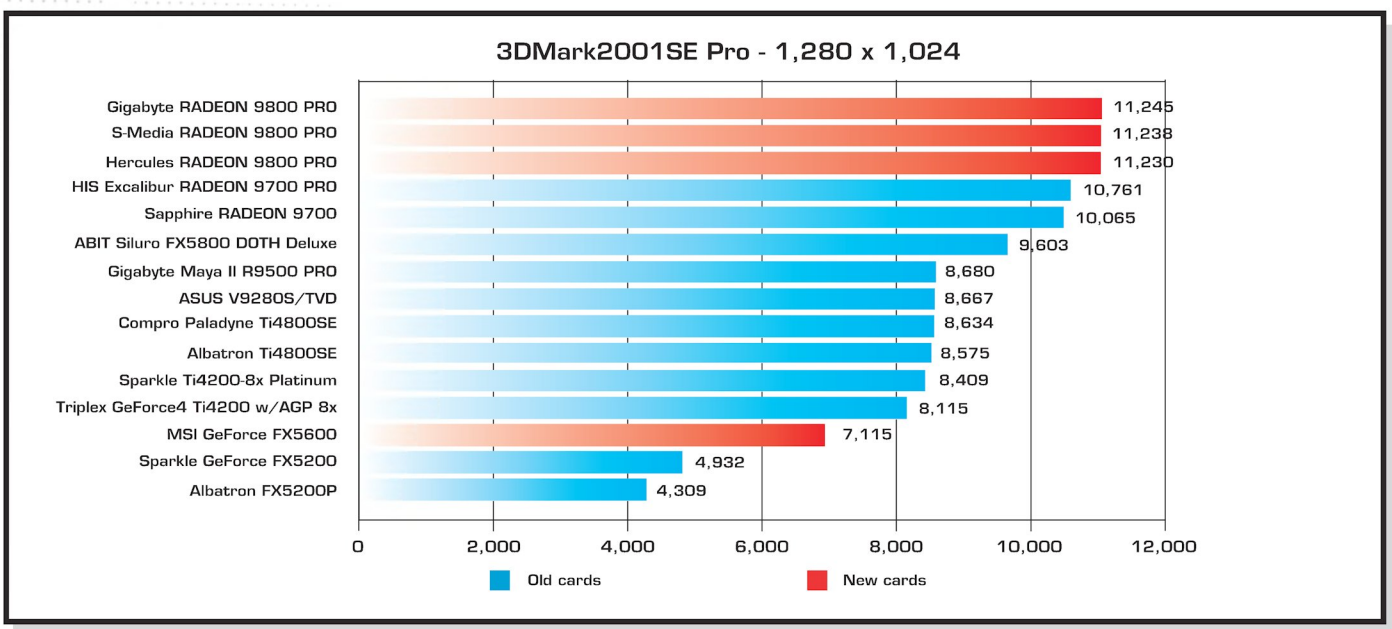


CPUs

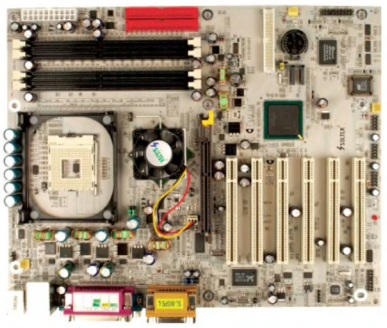
Now that we have the Athlon XP 3200+ and Intel Pentium 4 3GHz things are due to quiet down on the CPU front for a few months. Intel are set to launch a 3.2GHz Pentium 4 sometime soon but this is the only forseable CPU launch until AMD finally gets off its butt and launches the Athlon 64 in September.

For now the most exciting thing is the impending possibility of single CPU Opteron systems running on NVIDIA's nForce3 workstation chipset. Until now we have only seen server boards from MSI and Tyan, which support dual Opterons, but use integrated Rage-level graphics and hence have stopped us from getting a good picture of gaming performance with the CPU. nForce3 boards should be with us soon, and we will be subjecting them to the usual torture test in the *Atomic* Labs.

We have also been searching out news on ATI's serious entry into the Pentium 4 chipset market. The chipset, codenamed RS300, is only being whispered about by few, but those whispers are pointing towards outstanding performance from both the chipset and its integrated graphics core.



Soltek SL-86SPE-L <<<



Soltek, purveyor of all things shiny and glittery, is one of the first companies to release a motherboard based on Intel's eagerly anticipated i865 Springdale chipset. As you saw in John's feature on the i865 and i875 in last month's *Atomic*, there is a minimal performance difference between these two chipsets, with the i865 being substantially cheaper than the flagship i875. This makes it the obvious choice for those looking to move up to the 200MHz FSB Pentium 4s but don't want to pay the uber bucks to do so.

This motherboard uses the ICH5 Southbridge, which supports eight USB 2.0 ports, two Serial ATA ports, two ATA100 IDE ports and a couple of other things that are too boring to mention. Onboard sound and Ethernet support is provided courtesy of Realtek, but the sound isn't anything to write to mum about, providing basic 4.1 and a single input. Board layout is fairly clean, although it does suffer from a problem that is becoming increasingly common these days; a full-sized AGP card comes mighty close to the clips used on the memory slots, meaning you have to remove your video card to detach your memory. A strange glitch saw the motherboard supplying a voltage to the CPU roughly 0.075V lower than what was set; however once you know about this bug it's not a big problem to overcome. Pairing this mobo up with the beloved 2.4C, we managed to extract a maximum stable front side bus of 270MHz, which isn't far off the maximum FSB we've been able to extract from i875 based mobos. Regardless, an effective FSB of 1,080MHz, 35% faster than it's meant to run, is nothing to be sneezed at. One feature we aren't too happy about is the inability to manually adjust your memory/FSB ratio, although this seems to be a common complaint with i865 motherboards.

While this board has a couple of glitches, notably the memory timing and voltage reporting, it's still very good value, and is a nice match with the 2.4C. BR

Specifications:

Intel 865 chipset; two SATA; two ATA100; eight USB 2.0.
Website: Soltek www.soltek.com.tw
Supplier: Altech www.altech.com.tw
Phone: Altech (02) 9735 5655
Price: $230

7/10

Intel Pentium 4 2.4C <<<

Let's cut straight to the chase. If you're looking to upgrade your CPU, you need to send out the bloodhounds immediately to sniff out the nearest retailer of the 2.4C Pentium 4. Yes, Intel has done it again, releasing a CPU revision that overclocks like the clappers.

The new 2.4C Pentium 4 is actually a D1 stepping, but you'll be pleased to hear that *all* 2.4C's are of the D1 variety. No more decoding cryptic processor codes to figure out if the CPU you're about to purchase is the one you're after – just look for the big C. Maybe it stands for 'Crazy bargain'. . .

Two features make this chip standout from the rest of the lower-end Pentium 4s – it is the lowest speed Pentium 4 that ships with HT (Hyper-Threading), and runs on a 200MHz frontside bus (quad-pumped to give a theoretical bus speed of 800MHz). You'll need a motherboard capable of a 200MHz frontside bus, as the locked multiplier on Intel chips means you'll be running the CPU at a much lower frequency if you drop it to 133MHz. The D1 also runs at a slightly lower default voltage of 1.525V.

What really got us hot and bothered was the chip's overclocking potential. We dropped a sample of the 2.4C Pentium 4 into an ABIT IC7 motherboard, and were quite simply blown away by the results.

The 2.4C managed to flounder to the Windows desktop at a speed of 3.6GHz – using the standard Intel HSF that ships with the 3GHz Pentium 4. Sadly this speed proved to be very unstable. After a little tweaking we found the stable ceiling to be 3.3GHz. Yes, 3.3GHz. This was attained by raising the frontside bus to 275MHz (effectively 1,100MHz) with the voltage set to 1.7V – any more and you risk frying the delicate 0.13-micron innards of the 2.4C.

Considering it's retailing for approximately $380 (at the time of writing) and appears happy to run at over 3GHz, combined with the wonders of HT and a massive frontside bus, we can't recommend this CPU enough. You'll probably need to purchase a new motherboard to attain the quick bus necessary, but it'll be worth every penny. BR

Specifications:

12x multiplier; 200MHz FSB; 0.13-micron; 512KB cache.
Website: Intel www.intel.com
Supplier: AusPC Market www.auspcmarket.com.au
Phone: AusPC Market (02) 9746 0900
Price: $379.50

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iRiver iFP-195TC <<<

Walkmans. The guy at the bus stop hasn't *really* contracted some nerve disease. No vigilante brain signals have hijacked his appendages, making them flapping about merrily. Said nonexistent neural disorder also isn't responsible for his flailing limbs battering nearby seniors and pregnant women. Go and ask him what the hell he *is* doing, and after removing some secreted ear buds, he'll respond 'Groovin' man. Groovin.'

Damn those Walkmans. Thankfully, we now have MP3 players, which are smaller, better and funkier. The iRiver iPF-195TC meets these trends full on, being tiny, lightweight and high quality. And expensive.

Piled inside its packaging is a set of excellent Sennheiser earphones; a USB cable (6.4Mb/s, USB 1.1 only); a small pouch; a belt; and a lanyard – the last three all an appealing gun-metal grey.

The iPF-195TC's selling point is its onboard flash memory – a fantastical 512MB. It's also the sole reason for its staggering price of $689. Overkill for an MP3 player, considering a decent 256MB unit will set you back $250. It's a premium price for premium space.

A single AA battery provides power and gives the unit an unusual but comfortable profile. While the manual says you'll get 20 hours, high bit rate tunes will push this down to about ten.

Using the control knob to navigate the player's menus is tricky at first, as the buttons and knob change function with every menu. The knob could also have been more prominent, as its low profile makes it hard to trigger. The designers probably came to a compromise however, as the knob already easily catches on the lip of the pouch when you insert it.

As for sound quality, MP3s and WMAs played sweetly. The unit has great bass response, and this was especially impressive after cranking the volume.

iRiver has designed a fantastic MP3 player, and the only thing stopping it from being perfect is its high price, thanks to the 512MB of memory. Otherwise, it's hard to fault. LB

Specifications:

MP3/WMA player; 512MB; 8-320Kb/s; FM radio; recorder; Sennheiser earphones; 32g without battery.
Website: iRiver www.iriver.com
Supplier: JNC Digital www.jnc-digital.com.au
Phone: (02) 9264 8677
Price: $689

8.5/10

JNC SSF-200 <<<

Perhaps the best characteristic of MP3 players (when compared to Discmans and Walkmans) are their lack of moving parts. When there is less to fiddle with, there's less to break – just avoid solar flares, microwaves and rare earth magnets, and it'll continue to be prevail unbroken.

JNC's SSF-200 is a great example of a 'no fiddly bits' music player. The sleek and solid design is welcome, as is the absence of buttons. In their place are two dials, which not only add to the compactness of the device, but also to the simplicity of maneuvering its menus.

While the dials are easy to use, the abbreviations in the menus can be a little confusing – but they're nothing a quick flick through the manual won't decipher. What the instruction booklet won't explain is the stethoscope-shaped earphones that come in the package. Comfortable and great quality, yes, but don't blame your friends if they mistake you for Frankenstein's monster. Or Ernie the muppet.

The SSF-200 is a little heavier than the iRiver player above – but only by 10 grams. Like the iFP-195TC, the JNC model takes a single AA battery, has an FM radio and a voice recorder. It lacks the huge 512MB of flash memory of the iRiver, but the 128MB it does pack isn't inadequate. While 256MB is the optimal amount, 128MB will hold around 32 128Kb/s four-minute tunes – a bit more than you'd fit on a 700MB CD.

Sound quality and frequency response of the player are sensational; and the significantly more expensive iRiver is only a smidgen better when it comes to bass. The player handles high volumes well, and it can interpret the whole gamut of bit and sample rates.

As for software; after a quick driver and software installation, uploading music was a simple drag and drop affair. Capability is also there to drag CDA shortcuts straight from an audio CD; the software will automatically convert the tracks to MP3s.

Overall, the SSF-200 is an awesome performer, but like the iRiver, the real cringe factor is the price. LB

Specifications:

MP3 player; 128MB 8-320Kb/s; FM radio; recorder; earphones; 42g without battery.
Website: JNC Digital www.jnc-digital.com.au
Supplier: JNC Digital www.jnc-digital.com.au
Phone: (02) 9264 8677
Price: $379

8/10

Albatron

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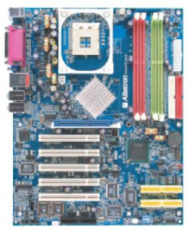

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- nView™ multi-display
- Bundled DVD player software

FX5200EP

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- 128MB DDR Memory
- AGP 8X with D-Sub / TV-Out / DVI ports
- CineFX™ engine supports Microsoft® DirectX® 9.0 & OpenGL1.4
- nView™ multi-display;
- Bundled DVD player software

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Soar to Success

Mustek DV3000 <<<

If you're in the market for a digital camcorder you could probably only afford a tube of thermal paste with the change left over from a few grand. So how the heck can a company deliver a $400 digital camera without constructing it from scabby Band-Aids and pop sticks? We weren't expecting much from this little tacker, but it's nice to be surprised every now and then. . .

The DV3000 uses a MultiMediaCard for storage, and ships with a 32MB card. This can hold around five minutes of footage at the highest resolution, or 14 minutes at the lower quality. Two AA batteries supply power, but sadly rechargables aren't included in the price. It has to be the tiniest DV camera available, weighing a mere 110 grams without batteries, and measuring 86 x 40 x 68mm. While this makes it a very convenient camera to take out and about, it's also an unstable device for filming, resulting in unsteady footage if you're not careful.

At the heart of the DV3000 is a 2.1-megapixel CMOS sensor, which can capture video at a maximum resolution of 320 x 240, and stills at 1,600 x 1,200 or 640 x 480. As you can see from these specs, this camera isn't going to replace your high end DV camera, but it does make it the perfect device if you're only capturing video for the Web. Even at the lower resolution we found the video capture to be of a quality perfectly acceptable for Net-based video clips.

A small 1.5in colour LCD flips out from the side of the device, identical to the higher end camcorders, making it simple to frame your shots. A four-level digital zoom is also included, but at the highest level of zoom we found the picture to be very pixellated.

In essence this product is just a mobile Web camera, which isn't a bad thing. If you're after such a device, and don't want to spend wads of cash on a high end DV camera just to capture low-res video, you can't look past this innovative gadget. BR

Specifications:

Two AA batteries; 320 x 240 video capture; USB/AV-out; 110 grams.
Website: Mustek www.mustek.com
Supplier: NATCOMP www.natcomp.com.au
Phone: NATCOMP (02) 9712 0099
Price: $399

HOT atomic MAXIMUM POWER COMPUTING 9/10

Apple iPod <<<

Even the most ardent PC-loving, Apple-loathing geek will grudgingly admit respect for Apple's original entry into the mobile MP3 player market, the iPod. We fell head over heels in love with the first version, so were more than happy to check out the new model of this stylish, feature-packed player.

The biggest difference is that the newer version isn't quite as big, with a reduced depth of 1.58 cm. It's still relatively heavy though, weighing in at a meaty 159g, making the iPod less suitable for those who want to use their player while working out – which applies to three Atomicans. The button layout has changed, with four new buttons above the cool touch dial on the original iPod.

Available in 10GB, 15GB and 30GB capacities, it's definitely a heavyweight when it comes to storage capacity – the largest model can store an astonishing 7,500 songs. Now if we only had a reliable music sharing application it would be perfect.

The interface and touch wheel of the iPod makes navigating so many songs a breeze, the new ability to program playlists on the road is sure to come in handy. Apple has even been kind enough to include a new docking port with the 15GB and 30GB iPods, making uploading songs a quick and painless affair. While we're used to synching data between our PDAs and PCs, the iPod is the first MP3 player we've seen that lets us do the same with MP3s. Another bonus is that the iPod can also be used as a mobile hard drive. Is there anything this player can't do?

But what you really want to know about is the sound quality, and as we expected the iPod also delivers in this regard. Regardless of how loud we cranked it, the music was always crisp and clear. Thanks to the amazing sound quality and its huge capacity, the iPod can easily double as a hi-fi MP3 player, making it even better value for money. Speaking of which, the iPod isn't as cheap as some of the yum-cha MP3 players that have sprung up over the last year or so. But considering how bloody good this player is, as well as the ability to mod it to allow many PDA-like functions, we have absolutely no hesitation in crowning the new iPod as the undisputed king of MP3 players. BR

Specifications:

10GB, 15GB or 30GB; USB 2.0/1.1 or FireWire; eight-hour battery life (rechargeable battery built into unit).
Supplier: Apple www.apple.com.au
Website: Apple www.apple.com.au
Phone: Apple 13 36 22
Price: $595 – 10GB, $799 – 15GB, $999 – 30GB

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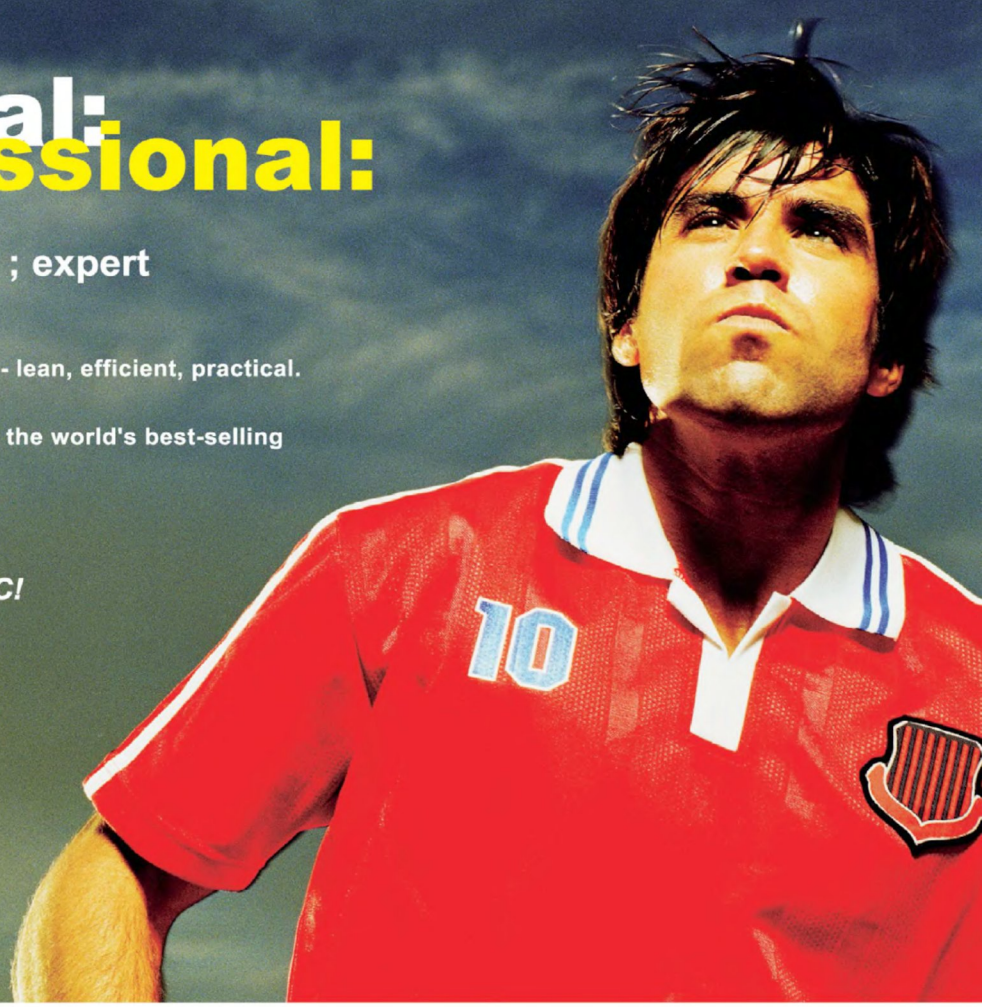

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Apacer Disc Steno <<<

Ah. . . the price of portability. Gadgety, yet practical portable things can generally be expensive, as is the Disc Steno from Apacer.

This device is an external CD rewriteable unit, with built-in reader supporting six types of memory card. It supports a USB 2.0 connection, and can be used standalone when burning the contents of your memory cards.

It also comes with a rechargeable 7.4V rechargeable Li-Ion battery, making it as portable as portable gets. According to the manufacturer, the battery provides up to an hour of recording time. As a result, the Disc Steno is a great solution for digital photographers in the field, who can dump the contents of their memory card to CD without the need of a laptop.

Although there are two multifunction slots for memory cards, which accept CompactFlash (CF) Type I and II, Microdrive, Memory Stick (MS), SecureDigital (SD), MultiMedia (MMC), SmartMedia (SM) and xD (with an optional xD-to-CF adapter), these slots cannot be used simultaneously. Instead, the device supports multisession burning, writing the contents of each card you may be using into a new folder with each session.

This is how difficult it is to use as a standalone device. Insert your memory card. Insert a blank CD-ROM. Push the button.

Now, if you find that a challenge, go read *Noggin*.

Admittedly, there is no way of controlling which files should be burnt when used standalone. With 1GB CompactFlash memory becoming more affordable, this could become an issue.

We tested the device with a 64MB CompactFlash card and a 128MB SecureDigital card, both chock full of JPEGs, MP3s, Word documents and PDF files. It took only a few minutes to flawlessly duplicate the contents of each onto a single CD-R.

For PC support, the device will operate under Windows 98/SE/2000 using the supplied drivers and bundled Nero software. Windows XP is supported natively. It will also work under Mac OS X, (but not 9.1) without drivers, provided that Toast 5 Titanium is installed, although this is not supplied.

The most attractive thing about the DiscSteno, apart from its sexy design and portability is that it just works. Fast and simple. SP

Specifications:

Capacity – 650-800MB; 2MB buffer; card support: CF Type I & II/SD/MMC/SM/MS; 24x CD-R, 10x CD-RW.
Website: Apacer www.apacer.com
Supplier: Blue Chip IT www.bcit.com.au
Phone: Blue Chip IT (02) 8745 8400
Price: $559

HOT atomic MAXIMUM POWER COMPUTING 9/10

Shuttle SB61G2 <<<

Just like brushed Aluminium was last year's black, the mini-barebones is this year's super-trendy accessory of geekdom. It's as though every company to ever make a motherboard is shrinking the PCB and throwing it into an Aluminium shoebox. Shuttle pioneered this concept with the XPC range, and is now selling a heck of a lot of these units as it continues to tweak its design and introduce the latest chipsets into its range.

The SB61G2 is based around Intel's newly released i865G chipset. While this chipset is slightly slower than the bleeding edge i875P, it supports the latest 800MHz FSB Pentium 4 CPUs, packs dual-channel DDR support (with only two RAM slots due to the space restrictions), and also debuts Serial ATA support for the XPC, with two SATA ports sitting next to the two Parallel ATA ones. It doesn't make use of Intel's new CSA Gigabit Ethernet technology, and instead relies on a tried and true integrated 10/100 port.

It also includes decent overclocking functions, however we recommend that the XPC be used fairly stock, as heat management can become an issue in the tight confines of the box. Unlike other manufacturers, Shuttle uses a custom-built heat pipe to cool the CPU and keep the noise and congestion inside the box down.

As usual we recommend that you bypass the integrated graphics and head straight for a separate AGP card. Like Shuttle's nForce2 unit, the SN41G2, the SB61G2 is free from the heat problems we used to see when using AGP cards inside the XPC. Pack in a RADEON 9800 PRO (unfortunately the dual-height layout of NVIDIA's new cards precludes them from being used inside the XPC) and you have a box that can keep pace with some of the fastest desktop units around.

This is another great unit from Shuttle; however the SN41G2 is still our favourite thanks to the comprehensive features, decent integrated graphics performance and audio quality of nForce2, which makes it a great box for any occasion. If you want the finest mini-barebones system for the Pentium 4, however, the SB61G2 is the one. JG

Specifications:

i865G chipset; audio with S/PDIF in/out; one PCI and one AGP slot; USB 2.0; IEEE 1394; SATA.
Website: Shuttle www.shuttle.com
Supplier: SATO www.satotech.com.au
Phone: SATO (03) 9899 6333
Price: $950

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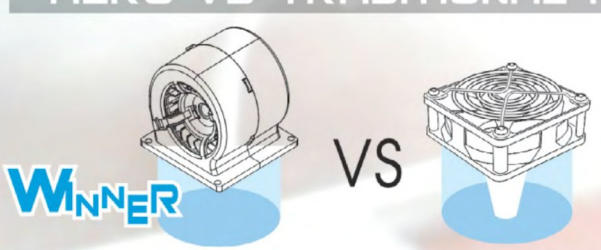

Air pushed directly & thoroughly into center of heat sink.

"Blind spot"underneath the fan resulted in loss of performance.

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Thermaltake SubZero 4G <<<

Heat shield and desk fan in hand, Bennett Ring sees what happens when Peltiers turn bad.

You know extreme cooling is no longer quite as extreme when the likes of Thermaltake start pumping out mass-produced versions that even a chimp would be comfortable installing. We saw it with water cooling in the Aquarius II kit from Thermaltake, and now we're seeing it with Peltier coolers.

The SubZero 4G is Thermaltake's quick and easy fix for those of you who are thinking of delving into the world of thermoelectric cooling, promising a 90-second installation and the same performance as a high-end HSF, minus the incessant buzzing of a high cfm fan.

This kit is comprised of two main components; a heatsink/fan unit with a Peltier element housed in the base, and a large power pack that fills a PCI slot. The kit is available in two flavours – Intel and AMD. The only difference between the two, other than the shape of the heatsink that the Peltier module is attached to, is that the AMD version has a copper base (to better handle the higher temperatures of the Athlon XP processors), and also has two settings – high speed and silent, with the high speed setting being substantially faster than the Intel kit – once again to handle the hotter AMD CPUs.

The reason for the large power pack is that Peltier modules like to suck down electricity quicker than a brickies labourer downing a six-pack after a hard day's labouring. A separate power cable extends from the rear of the PCI power pack, straight into your mains power. And yet it appears even with this measure, the SubZero 4G is severely underpowered. A separate LED case fan is also included to help keep case temperatures respectable, as the Peltier module will pump a lot of extra heat into your case's guts – not good news for PCs that are balancing on the brink of crash city thanks to overclocked components.

The PCI unit doesn't just handle the power needs of the demanding Peltier module. One of the biggest obstacles with Peltier cooling is condensation build up, as the Peltier module can get so cold that water will condense on and around it. Water, plus PC components, equals BAD.

The SubZero 4G overcomes this PC killer of a problem by measuring the temperature of the CPU as well as the ambient case temperature, and adjusts the flow of current to the Peltier to make sure that its temperature never goes below the dew point (the temperature at which water condenses). It's an effective solution that will no doubt be mimicked in future shrink-wrapped Peltier kits.

At absolute zero (-273.15°C, to be exact) molecules stop moving. In fact, it's so freaking cold that things can actually move through each other – making LN2 testicle-dipping even more hazardous.

For a Peltier to be effective, it needs to consume a lot of power – up to 150W to be precise. Yet the SubZero 4G only consumes a maximum of 73W, making this one severely underpowered unit. And it's for this very reason that the SubZero 4G is only marginally more successful at cooling your CPU than a rubbery cheese slice.

Thermaltake claim that the Intel kit is suitable for CPUs at up to 4GHz, while the AMD kit is quite comfortable taming a 3400+ Athlon XP. Yeah, and purple winged monkeys are about to start shooting out of my butt. They also claim that this kit can be installed in 90 seconds – thank God they didn't mislead about one thing; installation is as quick and easy as advertised.

Performance on the other hand. . .

We used Chernobyl to test both the AMD and Intel versions. It was set to output 60W (roughly the same thermal output as a 2000+ Athlon XP) and then 80W (roughly the same as an overclocked high end CPU). For comparative purposes we used Intel's Orb-like reference cooler that ships with the 3GHz P4, and a Thermalright SLK-800 with a Delta EFB0812HHE 4,550rpm 80mm fan strapped on top. Ambient temperature was a constant 21 degrees Celsius throughout the testing.

As you can see from our benchmark results, the SubZero 4G was thoroughly trounced by both heatsinks. And we're talking Iraq going to war with America trounced. We remounted and tested each unit twice, to make sure our results were accurate. They were. Sure, the AMD SubZero 4G was much quieter than the SLK-800 but with such woeful performance this kit is only good for those with a serious grudge against their CPU.

Adding further insult to injury is the cost of both kits. At a smidge over $250, you could easily put together a much higher performing Peltier kit of your own, and at half the cost, although you would then have to deal with the woes of water vapour.

As a result we simply can't recommend either of these kits. It must be remembered that this is Thermaltake's first attempt at mass producing a Peltier kit, so we're hopeful that the next version will have much improved performance. Until then, don't say that we didn't warn you. BR

Specifications:

Three-step microprocessor controlled Peltier unit; 73W maximum power consumption.
Website: Thermaltake www.thermaltake.com.tw
Supplier: PC Case Gear www.pccasegear.com
Phone: PC Case Gear (03) 9568 0932
Price: $253

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artomic

Baby got Loopback

We've had the bigger, better and faster rounds of game evolution, but finally John Gillooly sees developers aiming for *pretty,* thanks to DirectX 9.

In the time that I had set aside to write this month's column I ended up getting bogged down in a heated debate over driver cheats verse optimisations in 3DMark03; of whether NVIDIA or ATI's driver tweaks were as bad as each other, and how it relates to real world games. With that and the issues surrounding the GeForce FX 5900 Doom 3 benchmarks the real point of modern graphics hardware gets a little muddied.

In the end it's all about delivering damn good-looking games. Originally new generation graphics hardware releases were all about getting the best speed, however this has shifted somewhat to image quality. When you set raw speed aside, the most important thing becomes the functionality inherent in Microsoft's DX 8 and DX 9 APIs, which is what the actual games end up being written for.

Once I adjusted to the flashing lights, booming speakers and crazed activity of this year's E3 something hit me. Almost universally the games were looking better than ever. Now, I don't just mean that they have higher resolution textures or prettier colours, I mean that developers are now beginning to use the advanced features currently available in video hardware.

Pixel and vertex shading is all the rage, from the very obvious prevalence of shiny water to more subtle lighting effects. Whereas last year this sort of action centred on John Carmack's coding wizardry in Doom 3, this year everyone was jumping wholeheartedly onto the 'really pretty graphics' bandwagon.

And it shows. I don't mean to spoil the E3 report in the next few pages, but Doom 3 didn't even make my list of the top games of the show. This is due both to the non-interactive nature of the game movie being run, and that moody corridors seem to be more of the same next to the newer graphical techniques that are being used by other developers.

Don't get me wrong, Doom 3 looks like a good ol' romp; but like Quake 3 the real killer title will probably come along later thanks to third-party licensing of the Doom 3 engine. The game will still sell through the roof (and put a big hole in the sky), but I suspect that the predictions of massive hardware upgrades will not be purely Doom 3 specific at all.

Partly this is due to the bombshell announcement by Valve of the September 30 release date for Half-Life 2, but it is also due to the general standard of games being released. Even RTS games that I saw at E3 were using shaders to enhance the gameplay experience.

Gamers will know the primary reason for their purchase of the RADEON or GeForce FX 10 gazillion hundred is to play Half-Life 2 or Doom 3, but the benefits will then flow on to other titles, making games like Far Cry, War of The Ring, Deus Ex: Invisible War, Halo PC and S.T.A.L.K.E.R. all look fantastic.

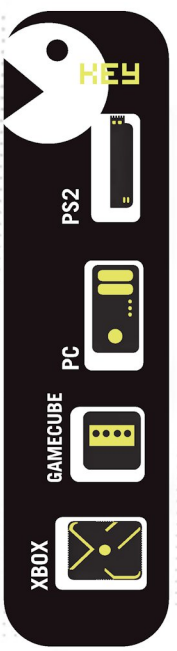
It is a real paradigm shift for the industry. It took years for fixed function hardware to transform and lighting to be used in games, but the adoption of DirectX 9-level pixel shaders is happening at an insane rate.

This needed to happen for the simple reason that we are now paying big bucks for graphics hardware that dedicates a huge chunk of its transistor budget to the blindingly fast floating point units that are at the heart of DirectX 9 shaders. We can get the framerate out of older cards, but they cannot do the wizardry that turns a good-looking game into one you want to show to all your mates.

Hardware companies realise this, which is why ATI and NVIDIA had unprecedented presence at E3. It is why company logos were adorning demo machines and booth staff throughout the show. In this realm NVIDIA has been more visible than ATI (one might say it had to be, as ATI was demonstrating Half Life 2).

It is also why I don't have too much of a problem with NVIDIA's 'The Way It's Meant To Be Played' campaign. Sure, this encourages developers to target NVIDIA's high-end platforms, but more than that it gets developers using DX 9 features.

Maybe we should stop the fussing and get back to just why high-end 3D cards continue to be bought: the games. As long as a game runs smoothly and there is no need to compromise on image quality then we all win, no matter which DX9 card we run.



artomic

'Gaming Nirvana' by Nathanael 'funnelbc' Jeanneret

I came up with the idea of gaming nirvana, you know – really being in the zone. I thought about this some more and the idea of a floating gamer with four hands like those Hindu-style pictures appealed to me. I gathered up some reference pictures and started to work. I used Illustrator to create the main elements – that took around four to five hours. The keyboard has about 500 points in it alone. I then imported into Photoshop and fiddled around with the lighting and blending of each layer. More time, more waiting, the working file was 240MB, which was an issue for my PC with only 256MB RAM. It took about two minutes every time I wanted to save it. All up, it took about eight hours to produce to completion.

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SHORT CIRCUITS

It'd be hard to resist a free, still in development, 3D MMORPG. Especially one with the amazingly original tagline of 'A Universe Is Not Enough'. James Bond material-stealing aside, no one is expecting PlaneShift to die anytime soon. The game already has a large community, and it's helping the developers test features and squash bugs. There's only one quest and the graphics engine (Crystal Space, http://crystal.sourceforge.net/drupal) is as slow as a swear word, but it *is* free! Visit www.planeshift.it for more info.

Sam Fisher looks set to delve into the world of covert ops yet again, with Ubi Soft announcing that development has begun on the sequel to Splinter Cell. It's called Pandora Tomorrow, and other than the new missions, characters and equipment, Pandora Tomorrow will have co-op multiplayer, so you and your mates can scare one another in the dark.

At last, the promised update for Unreal Championship has been released and should be available through Xbox Live from the 22 May. No details on what it fixes, but we're fairly certain it has to do with the deplorable frame rates and lag issues. And other stuff.

BUZZWORDIKAN:

Normal

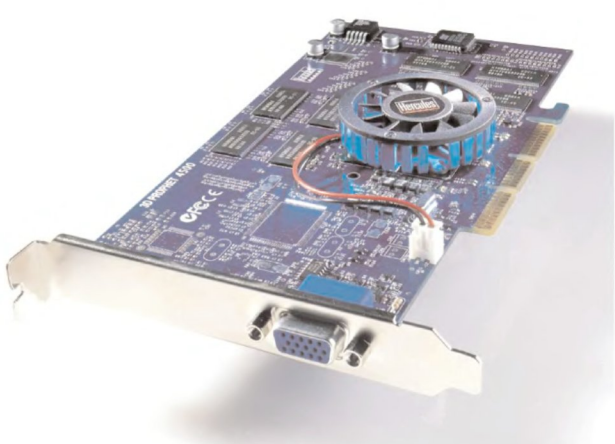
The normal is a vector. Roughly speaking, the surface normal at a particular point is a vector perpendicular to the surface at this point. Visually, for any polygon, you can picture the normal as an arrow piercing the polygon centre at right angles to its surface. Why are normals important? All lighting and shading calculations are based on them.

The art of faking geometry

Scanner – good for the odd bit of gaming news, quotes, and pretty pictures with motorbikes. . . and some James 'Geo' Wang goodness.

Without even thinking, list the three best-looking games in development for any given platform. Doom 3 would probably be around the top of the list, with others like Unreal Engine-based games, S.T.A.L.K.E.R. and Far Cry not too far down. Halo 2 would undoubtedly be mentioned, with Silent Hill 3 and Resident Evil 4 fighting for the top seats on console platforms. This isn't a debate about which one is technically better; they are all jaw dropping in their own right. What is interesting about the above games is that given a similar scene, both will look roughly the same in complexity but one of the engines is using only a tenth of the polygons as the other. Given that this technique has been around for a decade and hardware support dates back as early as the GeForce 256 (NV10), it may not sound so crash hot. But when Doom 3 and Halo 2 both swear by it, you know it deserves attention.

So what is this technique I refer to? It doesn't actually have a proper name, but has been referred to as 'normal mapping' or DOT3 bump-mapping. To fully appreciate this, take a moment and think what bump-mapping is. Actually, what is mapping? In the real world, there are no texture maps; all objects are built from point like atoms. The ideal 3D representation would be linked verticis, or polygons. Texture mapping exists as an approximation for flat surfaces. It's the greatest hack of all time in 3D – instead of drawing a wall with a billion tiny triangles with unique colour for every vertex, you simply use two triangles and plaster a texture on top. For the longest time, this worked wonders, until game designers needed walls that were, well, not so flat. Armed with so much raw graphics power, you'd think artists would stop cheating and build detailed models. But thanks to NVIDIA and ATI, better blending modes have been added to the hardware along side the extra geometry capability. New blend modes means better cheats, and normal mapping is the granddaddy of illusions.



Meet the Hercules 3D Prophet 4500. It's a Kyro II video card, and was lucky enough to use PowerVR's tile-based rendering technique. No T&L, pixel or vertex shaders. . . but no mammoth heatsink!

To see how normal mapping works, we need to visit a more fundamental problem: what makes things look 3D in the first place? Suppose I held a render of a cube perpendicular to your face and you were strapped in a chair – Clockwork Orange style – with no freedom of eye or body movement, how would you know if it's a picture or a 3D cube? To know it's a picture, you need at least a tiny amount of movement. If the object is truly 3D, a slight movement on your part will

cause an immediate change to the lighting information your eye receives, whereas a photo with its 'pre-baked' lighting information will incur no change. Armed with this simple observation, we can conclude that regardless of the existence of actual geometry, as long as the lighting suggests that it exists then we can create a convincing illusion that it exists for near perpendicular viewing angles. A normal map is precisely that, a texture that stores information about geometry presented in the form of a normal vector (check out the Buzzwordikan box on the definition of a normal).

The idea of using normals and lighting to fake geometry dates back to the first generation 3D accelerators with emboss bump-mapping. Back then, any feature sold chips, and with pictures of bumpy floor textures, even S3 cards sold like pancakes. Emboss bump-mapping changed pixel normals via a simple height map. Often just stored as a greyscale image in the alpha channel, the height map information tells the lighting equation how much relief a certain pixel has; the brighter the value, the greater the relief. The relief value is typically clamped between a value of [-0.5, 0.5] where the negative indicates depression.

This technique is extremely easy to implement as these maps could be generated from the base texture through a simple filter. Although this was good for the random bump (orange peel), arbitrary detail would require pixel by pixel editing and the end results were too inaccurate.

Soon afterwards came environment-based bump-mapping, which although was highly publicised and delivered good results, did not receive wide adoption. The fact that the same Expendable screenshot has been used countless times to illustrate such a 'promising technology' didn't help either. The core concept is good, requiring three maps to simulate a material compared to two in emboss bump-mapping. The need to manipulate some matricis and a third texture meant specific hardware support was required, slowing the uptake considerably until this feature was unified into the programmable shader model. Since then, EMBM has taken new forms with greater flexibility and adoption. However, even with the added flexibility, the geometry one could simulate still couldn't be fine-tuned; a more robust way of simulating geometry was required.

We now know by moving pixel normals up and down, we can get the lights to be calculated at those new positions and simulate some elevation. However it's hard to paint these positions in 2D to represent specific details. What we need is to shift these normals in 3D – from actual geometry, then use these for shading. Imagine taking a million polygon character and storing the normals to details like armour bevel, dents and bolts into our normal map. Unlike the greyscale height map, our new normal map has encoded in it actual information on geometry details. Each pixel has information on where it's pointing (normal vector), the key to lighting the pixel realistically. The artist can now strip the model to the essential silhouette, say around 2,000 polygons. Where the detailed geometry was stripped, their information is tightly encoded in the base texture map along with the respective normal map. At run time, all shading calculations are done as a dot product between the light source and this normal map. As the normal map carries all the geometry normal information of the million-polygon model, all lighting is done on the 2,000 polygon model as if on the high resolution geometry. What we've achieved is light, simple model with the illusion of bumps and detail from the information extracted from a high polygon model. The end result is so convincing that to the non-discerning viewer, they are on par to the original. Convincing geometry compression with such amazing results is not easily ignored. It should come as no surprise that the best looking games of this year's E3 use this form of bump-mapping. Doom 3 and Halo 2 owe their glory to this technique.

Texture mapping . . . It's the greatest hack of all time . . . instead of drawing a wall with a billion tiny triangles . . . you simply use two triangles and plaster a texture on top.

There are of course limitations to normal map-based bump mapping. Because the illusion is created with lighting rather than real geometry, you obviously can't create a body and bump map an arm out of it. Also, any bump-mapped details will not show on the silhouette of the image. For example, using normal maps, a cube can be made to look like a sphere (shading wise), but the outline would still appear as a cube. This puts a physical limit on the height of bump mapped detail to low lying surface features only.

Normal mapping is not a new technology. Rather it is a fast, effective yet mature technology. The first engines to use it are already giving its competitors a hard time. With geometry savings over ten fold for characters, the extra power is channelled to other things like realistic shadows, enhancing world detail and more robust environments. Not long from now it will be standard, and we'll be able to say farewell to the flat, blurry world of primitive texturing.

JW

DEVELOPER QUOTE OF THE MONTH:

'Trying to keep boneheaded-ideas-that-will-haunt-us-for-years out of DirectX is the primary reason I have been attending the Windows Graphics Summit for the past three years, even though I still code for OpenGL.'

John Carmack, id Software (.plan 29/01/03)

E3-03: Slow, wet, ragdoll action

After a week in LA, John Gillooly returns to Oz looking like a ragdoll himself. Luckly for all of us, he's jetted back with his arms greatly full of gaming goodness. We, uh, helped ourselves.

Los Angeles is already one of the weirdest places on Earth. But when the game industry descends for its annual E3 pilgrimage things get really odd. It's a place where you can walk past Tooru Iwatani, the creator of Pacman, on Hollywood Boulevard, or almost get knocked sideways by Anna Nichole Smith's more than ample bosom right next to the Take 2 Interactive stand inside the LA convention centre.

The games industry goes a little bit Hollywood for the week, but hiding behind it all is E3, a games showcase unparalleled the world over. It is a strange car crash of colour, light, noise and celebrity, with an unnatural dose of bona fide military personnel to boot (thanks largely to America's Army).

There is a minimal hardware presence at E3, mainly NVIDIA and ATI and some peripheral makers, but this year there was an exciting shift in the way developers are pushing PC hardware. In the past there has been a major lag of several years between the rollout of hardware features like hardware transform and lighting and the actual implementation in games. But this gap has closed remarkably, with generous use of pixel and vertex shaders evident in all manner of titles.

A lot of this can be put down to programs like NVIDIA's 'The way it's meant to be played' campaign. The graphics card manufacturers are driving developers to implement not just DirectX 8 but DirectX 9 features in their games. And the results are stunning. When I was first compiling my list of big titles from E3, Doom 3 didn't even rate. It blew minds last year with its dark and moody graphics engine, but this year games needed more than just good looks to grab peoples attention.

2003 is the year of shiny water, ragdoll physics and bullet time. Over the three days of the show I saw more floppy bodies than anything else. It's really cool and all, but everyone is doing it to varying degrees, and it is no longer a standout feature of a game.

S.T.A.L.K.E.R: OBLIVION LOST

Developer: GSC Gameworld
Publisher: THQ
Platform: PC Release date: TBA

Coming from deep in the Ukraine, S.T.A.L.K.E.R. is set in a 30-square kilometre area around Chernobyl called The Zone. You are a Stalker; one of the futuristic hunter types that prowl the area. Thanks to omnipresent AI the experience will change with every replay of the game.

The X-Ray engine, with high-res textures and vast landscapes, makes for an immersive experience appealing to the gaming and techie sides of the *Atomic* mindset.

Consolidation is the key word for the console industry this year. As all players now nervously rev their engines and keep an eye out for which one will make the next generation jump first, focus is well and truly on the games, and there are some mighty fine titles in the pipeline.

Nintendo began E3 with an unusually contrite presentation, highlighting the shortfalls of the GameCube so far, and making a

commitment to work with more third-party developers, and to embrace a wider age group. To demonstrate this, they showed off a new Pacman title that takes advantage of the Game Boy Advance-to-Cube link function, and a new Metal Gear Solid title. It has also realised the need to push its wide stable of loved characters, so new Mario Kart, Wario, Pokemon, Zelda, Metroid and Starfox titles were shown off.

Sony's press conference was overshadowed by the bombshell announcement of the show, the PlayStation Portable (PSP). This unit is tentatively scheduled for a late 2004 release, and employs a hybrid DVD mini-disc to fit 1.8GB of data onto a tiny cartridge. It will be 3D accelerated, and Sony has specifically mentioned the use of NURBS (Non-Uniform Rational B-Splines) to enhance the look and feel of the graphics. Both Nintendo and Nokia will be quaking in their boots as the success story of the console world goes mobile.

Nokia's N-Gage was also being pimped around, but it was really failing to impress. There is still significant effort needed to get the frame rate up to a playable speed in most of the titles shown. Red Faction, being done by John Romero's Monkeystone games, was marred by a jerkiness that made it look unplayable; even though Romero was standing up saying that it was running at full speed. Nokia need to stop pushing the N-Gage as a mobile gaming device first and foremost and concentrate on its strengths as the ultimate mobile convergence device. My sneaking suspicion is that Nokia see N-Gage as a way to push their GSM phones and grow the network in the CDMA-dominated US landscape.

When launched, Xbox rode on the back of Halo, so it was refreshing to see that Microsoft is really getting behind the first person shooter. Its press conference started with a little title called Doom 3 and launched into a string of new titles, expanding additional franchises and debuting the new titles by the recently purchased Rare. During the whole presentation, perhaps the biggest applause from the strangely effusive audience came for Soul Calibur II and Conker: Live and Uncut. It finished with a live demo of Halo 2, which is looking absolutely stunning. The demo gave a glimpse showing that Bungie are really working to make this the best game yet on the Xbox.

The show itself was the usual crazed chaos, with media and PR rushing to and from appointments almost colliding with the tire kickers, there to play a few games and get some free T-shirts. It was so crazy at times that my scheduled meeting with Gary Coleman and the Postal 2 guys didn't happen; they had been escorted from the premises by security for taking attention away from the actual exhibitors.

Most popular inside the show was by far the Half-Life 2 theatre at ATI's stand. With an average four-hour wait to get inside, a line snaked around the booth for the duration of the show. Loudest stand definitely went to EA, best stand design to Activision and most crowded to Microsoft.

MYTHICA

Developer: Microsoft Game Studios
Publisher: Microsoft Game Studios
Platform: PC Release date: 2004

MMORPGs were all the rage at E3, but Microsoft's Mythica was a standout. Using a combination of public and private zones, this game aims to get past the 'just another pleb' feeling of current MMORPGs by using private zones in which quests occur. These areas feature only you and your chosen comrades, and allow for the wealth of epic story-driven battles and missions that we love in single player games.

FAR CRY

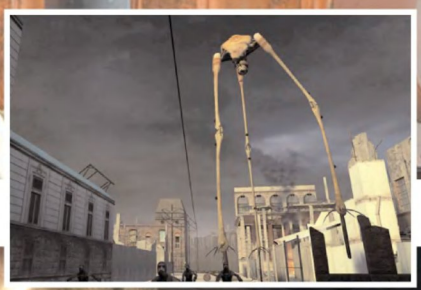
Developer: Crytek Studios
Publisher: Ubisoft
Platform: PC Release date: Q4 2003

One of the most amazing first person shooters shown at E3, Far Cry is set on a giant militia-infested island, with huge draw distances and some of the best long distance sniper action yet seen.

The CryEngine used for the game is astonishing, capable of rendering huge open areas and tight foliage-rich jungle with ease. Add to this deformable terrain and advanced enemy AI and Far Cry seems set to provide a hugely refreshing FPS experience.

There were a few constants flowing through all the different game demos that we saw. Anything that was on multiple console platforms was being demoed on Xbox and looking damn damn fine too. The majority of PC games were running on GeForce FX 5900 cards, of which NVIDIA had around 500 on the show floor, and most of the really exciting games were kept behind closed doors.

But in the end it is all about the games. The overall standard this year was amazing, and mainly from titles due before the end of this year. But there was one game that made every other one pale in comparison, which will undoubtedly achieve the market dominance on PC that GTA has on console. That game is Half-Life 2.



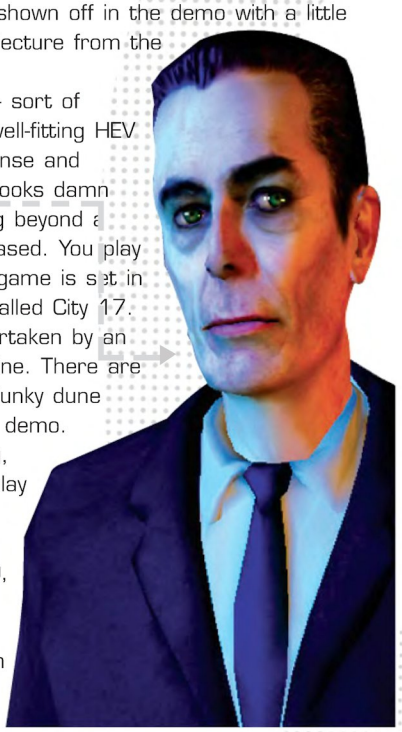
HALF-LIFE 2

Developer: Valve
Publisher: Vivendi Universal Games
Due: 30 September 2003

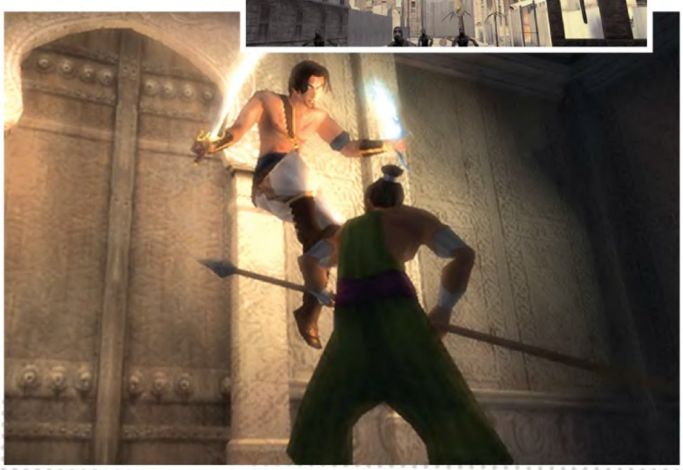
I am so sick of first person shooters, I really am, but half an hour in the theatre watching Gabe Newell show off the Source engine and the game had me filled with a new sense of hope. Half-Life redefined the way we looked at storylines, level progression and enemy AI. The sequel does the same thing for environmental interaction and physics modelling. Everything in the game has real physics attached: you can shoot out chunks of wood, watch a mattress fall realistically into a pool of water, use a barrel to deflect shots and then throw it at an encroaching zombie to knock it into the water.

Another amazing feature is lip synching, which has been taken to a whole new level of total facial movement with Source. Using simple WAV files, the engine makes it look like a character is actually speaking, shown off in the demo with a little lecture from the well known G-Man.

It's undeniably Half-Life – sort of melting around you like a well-fitting HEV suit. The gunfights are intense and different and the storyline looks damn intriguing given that nothing beyond a few nuggets has been released. You play Gordon Freeman, and the game is set in an eastern European city called City 17. The city is slowly being overtaken by an alien race called the Combine. There are vehicles, as shown with a funky dune buggy driven around in the demo.



Graphically it is stunning, and the glimpses of gameplay look both innovative and intense. When this game launches on September 30, in less than six months time, gaming is set to be forever altered. Better than Half-Life? You better believe it.



Prince of Persia: The Sands of Time

Developer: Ubisoft Montreal
Distributor: Ubisoft
Due date: Q4 2003

I don't know what they put in the water in Montreal, but Ubisoft's studio there is pumping out some damn fine games. Following up from last year's stunner, Splinter Cell, one of the other teams is putting together a new Prince of Persia game, under the watchful eye of creator Jordan Mechner. Unlike the abortive mess that was Prince of Persia 3D, this is staying true to the original's emphasis on fluid movement and solid platforming goodness. The PS2 version of the game was demoed, and it took a little while to realise it wasn't Xbox – the graphics are simply stunning.

Movement is fluid, with the prince flipping, swinging and leaping his way through the enormous palace that the game is set in. He has to stop the chaos unleashed by the sands of time, a mystical force that is set to cause some very bad mojo indeed. The sands play an integral role in the game, as you must kill enemies with a special dagger and harvest the sands, which can then be used to fast forward or rewind in-game. Stuff up a tricky bout of platform leapery and you can rewind to save redoing the level, or use fast forward to invisibly jump between

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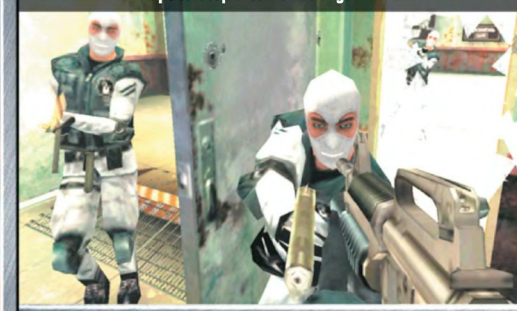

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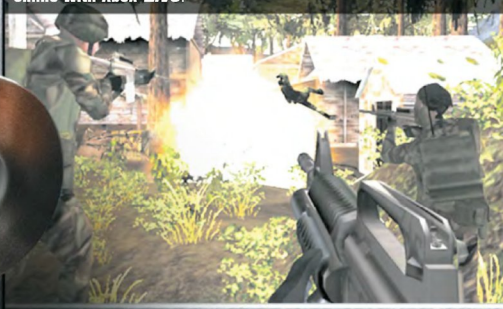

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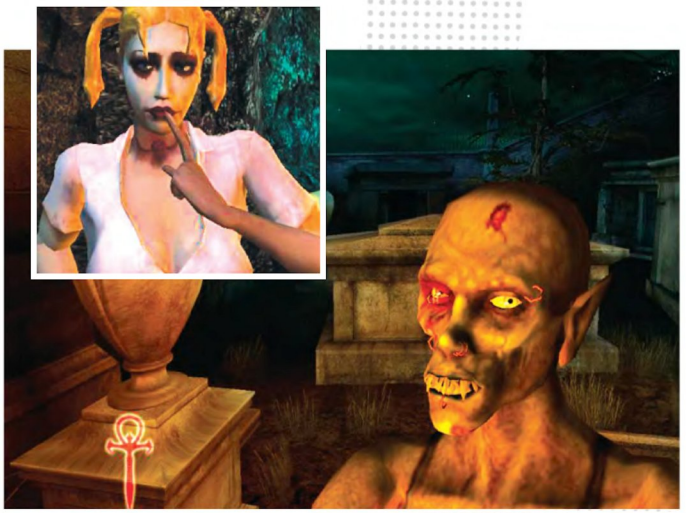
baddies, slashing as you go.

Prince of Persia was the finest platformer on display at E3, and one of the best damn games shown all week, managing to capture the essence of the original but still provide a game tailored to the modern console experience.



Vampire the Masquerade: Bloodlines

Developer: Troika games
Distributor: Activision
Due date: Q1 2004

All the ingredients behind this first person RPG point towards a classic title. Based around White Wolf's Vampire pen-and-paper game, and riding on the flawed masterpiece that was Vampire the Masquerade: Redemption, Bloodlines is being done by Arcanum creators Troika Games and uses Valve's new Source engine.

A standout at E3 with the 'Vampires and Boobies' booth babe philosophy, this title is set in modern LA and you are a member of one of the seven vampire clans. Each clan has its own attributes and basic skills, for example the Nosferatu are hideously deformed beasts that must use the sewers to travel around the city.

The game is a non-linear RPG that allows you to join any of the clans and work your way through the story. You must obey things like the Masquerade, a pact between the clans (collectively known as the Kindred) to keep the existence of Vampires secret. Feed in public too often and you will suffer the wrath of the Kindred as they hunt you down to stop you from blowing their cover. Simulating the struggle between the demon and human side of a vamps personality, you must keep an eye on your Humanity; let it fall too far and you lose control to the beast within.

All the ingredients are there for Vampire to blow all other first person RPGs out of the water. If Troika can infuse even half of the amazing roleplaying experience of Arcanum into Bloodlines then this game will be bloody marvelous.

CONKER: LIVE AND UNCUT

Rare's foul-mouthed alcoholic squirrel, Conker, is back in this multiplayer shooter for Xbox Live. Fun, colourful and disturbingly adult, it will include Conker's Bad Fur Day as well.

Hidden and Dangerous 2

Developer: Illusion Softworks
Distributor: Take2 Interactive
Due date: Q4 2003

Coming from Mafia creators Illusion Softworks, this follow up to the original squad-based WW2 tactical shooter stood proud among a ridiculous number of similarly themed games being shown. Graphically stunning, thanks to the LS3D engine, H&D 2 takes a new approach to the genre and will satisfy both the shooter fans and the realtime strategists.

There are three views from which you can play H&D 2; First person; third-person and realtime strategy mode. Third-person is preferable if you want an action approach as the game depends heavily on the manipulation and strategic positioning of your team. RTS mode lets you take a more considered

STARCRAFT GHOST

Developer: Blizzard
Publisher: Vivendi Universal Games
Platform: Xbox, PS2, Gamecube Release date: Q4 2003

It has been a while since Blizzard did a console game, and Starcraft Ghost is looking damn fine. Essentially a third-person sneaker, you play as Nova, one of the Terran Ghost operatives.

An incredibly fluid and dynamic gameplay experience is evident, and the immersion within the much-loved Starcraft universe is outstanding.

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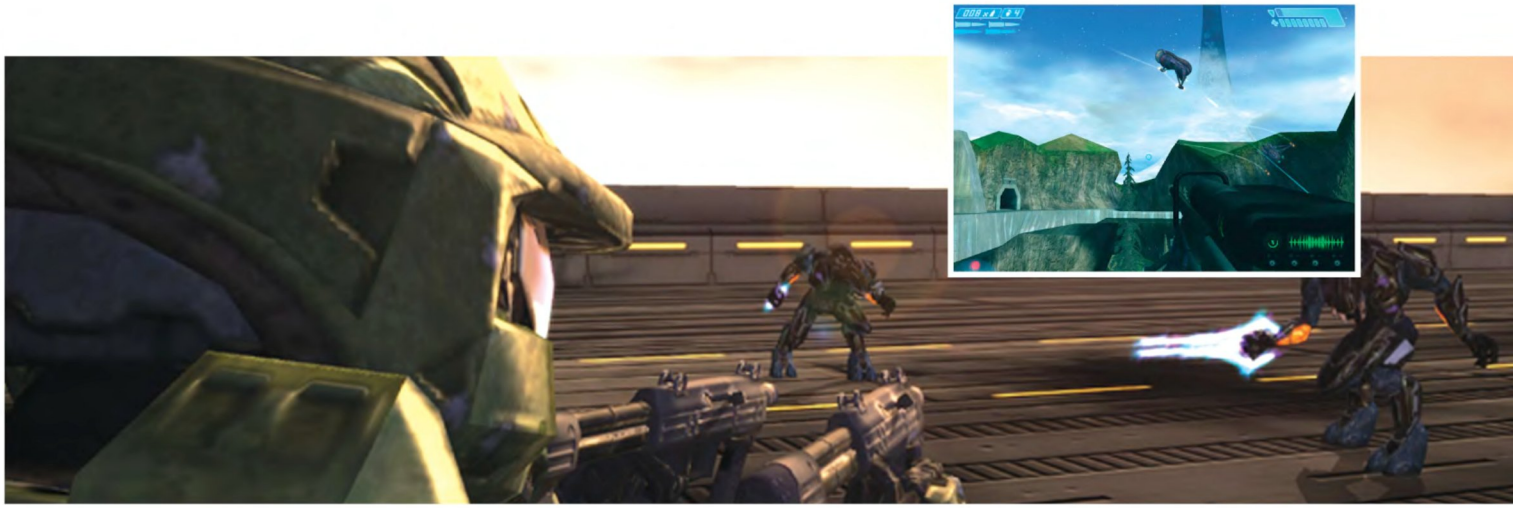

approach and concentrate on high-level strategy, which will help to extend the game's longevity even further. For those wanting a more pure first person experience, there is a lone wolf mode a la Rainbow Six in which you can attempt missions solo.

Realism is at the heart of this retelling of the British SAS' history during WW2. Voice commands to your units will only be heard and obeyed if they are in earshot, your team can steal uniforms or any other equipment from downed German guards, and you need to play close attention to which specialists and load-outs you use in the planning stages of each mission.

Halo 2

Developer: Bungie
Distributor: Microsoft
Due date: Q1 2004

If it wasn't for Halo, the Xbox would not have built the following it has. This landmark console first person shooter sucked-in jaded old gamers and newbies alike with its slick gameplay, good looks and compelling storyline. Bungie has followed Halo up in the best way possible, with the E3 sneak peak of gameplay showing a game that takes the Halo story onboard but brings it into a new realm: futuristic Earth.

The demo is set in New Mombassa, a hideously large future city covering the eastern seaboard of Africa. You, as the Master Chief, are dropped into the middle of a raging battle against Covenant forces for control of the city. First shown during the press briefing, this was accompanied by an almost evangelical reaction from fans, as the Master Chief first showed off some dual machine pistol-wielding action, and then leapt onto an approaching Ghost hover vehicle, kicked out the driver and zoomed off into the distance.

Cinematic in presentation and epic in scale, Halo 2 was the standout of a whole new generation of Xbox first person shooters. It overshadowed Doom 3 at the launch by a long shot, and when it ships it should plunge gamers straight back down the nostalgia path as they bask in the glory that is Halo 2.

BATTLEFIELD COMMAND

Developer: 1C: Maddox games
Publisher: Codemasters
Platform: PC Release date: Q2 2004

Battlefield Command looks to blur the boundaries between RTS, RPG and war games. Each soldier in the game has his own set of attributes, which grow over the course of the game, and each unit has a specific physic model attached, which helps to get past the 'wear down the health bar' gameplay that is so prevalent in RTS.

With over 100 single player missions and 300 distinct unit types, Battlefield Command is the biggest thing to happen to RTS in years.

SPACE COLONY

Developer: Firefly studios
Publisher: Gathering
Platform: PC Release date: Q3 2003

Think of this as The Sims meets *Red Dwarf*. This title has you building space colonies and dealing with personal interactions of your crew. It avoids inherent problems with previous games of this ilk, like Startopia, by adding the psychological management aspect that comes with the divergent personality types. This has a very real chance of grabbing not only builder game fans, but also the legions of Sims addicts looking for the next gaming experience.

The most common comment overheard in LucasArts' booth was 'So which of these machines is showing Sam and Max?' None of them were, and the only content about the game at E3 was a trailer screening near one of the entrances. There was a severe underestimation of the expectations behind LucasArts' return to the graphic adventure, and even though it's no Day of the Tentacle, we hope that Sam and Max: Freelance Police is as good as the trailer looks.

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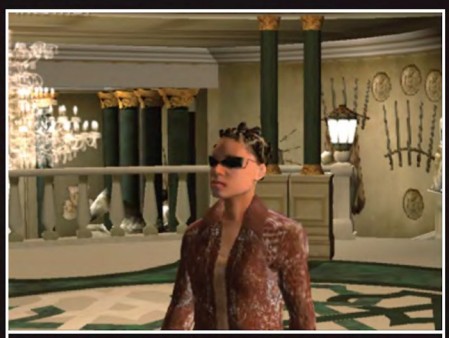
Enter The Matrix <<<

Red or blue pill? Bennett Ring would rather take the arsenic pill than play this game.



Surprisingly, these screenshots look much better than the game in action.

Look Ma, I can fly! Weeeee! Oh dear, I'm about to land on my face. . .

The arrow thingy is often the only way to figure out where the hell you're headed.

Games like Enter The Matrix are why mags like *Atomic* exist. If we didn't you'd probably rush out and buy Enter The Matrix thinking if it was even half as good as the first movie, it's still going to be a kick-arse title. And then you'd be feeling a mixture of both betrayal and extreme anger after laying out $109 (yes, $109!) for this over-hyped and disappointing game.

When you first fire up ETM, it's hard not to be impressed by the overall Matrix-ness of the game. It really will feel like you've slammed a metal plug into your neck, and can pull off moves that make Superman blush. However, within minutes you'll realise that it isn't a *Matrix* plug jacked into your brain; but a wooden skewer wrapped in foil with the dregs of a chicken satay stick still attached.

You'd expect to be playing the central hero, a certain god-like character that goes by the name of Neo. Nope. You have the choice of playing as Ghost or Niobe, a tough chick who likes nothing more than driving cars at insanely high speeds. Once you've chosen your character, you're stuck with them until you finish the game. Playing as either character makes each level a different experience. For example, during driving missions, as Niobe you'll be doing the driving, while if you play as Ghost, the abominable AI takes care of the car negotiating as you hang out the passenger window and blow stuff up. But more about the retarded AI later. . .

Much like the *Die Hard* games, ETM has three distinct modes of play. Most prevalent is the third-person action scenes, playing very similarly to Max Payne, but nowhere near as good. Then there are the drivey bits, and finally the flying bits, where you take control of the Osiris. Sadly each of these game types suck just as hard the rest. Three crappy game types do not a good game make.

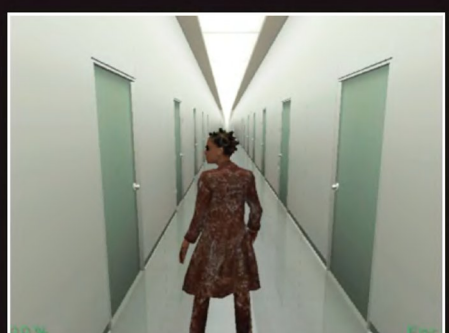
After seeing the *Matrix* rip off in 3DMark2001SE Pro (the lobby scene), which was developed two years ago, we had high hopes for the visuals in Enter The Matrix. When the opening scene reveals a car with octagonal wheels, we knew that things weren't looking good – literally. Probably the biggest disappointment of the whole game, the graphics in Enter The Matrix are quite literally shocking. Everything has a chunky, blocky feel to it, with incredibly bland and repetitive usage of a handful of textures. The motion captured animation goes some way to redeeming the woeful modelling, but even this is ruined by some severe clipping problems. It's rather funny to watch a guard fly across the room after your spin kick misses him by several feet. . . guess he was just scared you might actually hit him, so faked it to avoid bloodying his pretty face. Speaking of faces, enemies are grouped into generic models. So all cops look identical, as do all SWAT officers – in all, there's a remarkably small number of character models. Walking into a room with five identical bad guys reinforces the notion that you're playing a crappy game.

Crappy graphics would have been acceptable if the gameplay was mind blowing. And the gameplay does blow one thing – a herd of mountain goats. The control system is quite frankly atrocious, making us question whether or not the developers have ever actually played on a console. The camera tends to get lost on corners or present you with the worst possible viewing angle. Level design is incredibly plain and boring. The driving model looks like it was a straight copy and paste from Outrun on the C64. I'm sure the AI code for ETM took up all of 100 lines, both friendly and enemy – it's about as dumb as AI can get. The only redeeming feature of the gameplay is the cool moves you can pull off when using 'focus' (think of the bullet time in Max Payne), allowing you to do spinning kicks off walls, cartwheels and other assorted funky stuff. However, after watching the same move for the hundredth time you'll soon realise just how few of these special moves there are.

Yet after reading this, people are still going to buy Enter The Matrix – probably for the 50 minutes or so of extra *Matrix* footage filmed at the same time as *Matrix Reloaded*. But is it really worth paying $109 for 50 minutes of mostly boring, conversation-based footage? Hell no. . .

We had high hopes Shiny could pull off a successful Matrix game, especially after it was reported to cost $30 million to develop. After enduring ETM, Shiny has proved itself to be a money-hungry, franchise-destroying monster, releasing one of the worst movie tie-ins the gaming world has ever seen.

4/10



GAME DETAILS

DEVELOPER: Shiny Entertainment www.shiny.com
PUBLISHER: Atari www.atari.com
DISTRIBUTOR: Atari www.atari.com
PHONE: Atari (02) 8303 6800

O: 50 minutes of extra footage; it's a game based on the *Matrix* and. . . 50 minutes of extra footage.
O: Everything else.

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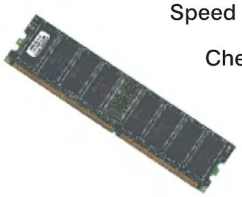

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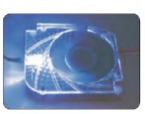

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Rise of Nations <<<

Des McNicholas has been bravely battling tectonic movements. . . or is that Teutonic?

When in doubt, an ICBM is always a good idea for clearing the air.

The strategy map lacks excitement, but it brings some new elements to the RTS format.

Great Zimbabwe finds itself under the wrong flight path.

Developer Big Huge Games set out to bring a new flavour to the realtime strategy genre, and it's fair to say that Rise of Nations goes a long way towards achieving that goal. Rise of Nations is a deft mix of traditional RTS gameplay, a very basic but innovative strategy system, and neatly balanced combat and economic elements. At first glance it doesn't look like the groundbreaking title promised on the box, but Rise of Nations rewards extended play with a good mix of civilisations and unit types, excellent technology trees, top-end graphics, and the chance to cram terrific games into a short space of time.

Rise of Nations spans 18 civilisations and 6,000 years of development, from hunters and farms of the Stone Age to the full mix of Information Age knowledge and technology. The excellent Quick Battle mode is supported by reasonable tutorials and a strategic Conquer the World campaign that lets players pick their targets and gain bonuses on the way to world domination. Eight-player multiplay is supported via LAN or Internet, and a solid scenario editor is included. Rise of Nations plays very well as a high-end RTS title, but newcomers will also find it a great introduction to the genre.

Things generally start with the gaming equivalent of two dollars, a piece of string and a live chook. The immediate task is to build the basics of a small settlement, establish a thriving economy, and provide some rudimentary defence. Early mission objectives tend to revolve around resources and minor conquests, but the emphasis is very much on establishing the libraries, universities and markets needed to advance through the game's eight historical epochs. The construction system is simple and nicely presented, with tool tips galore to set players on the right development path and terrific animations to keep track of progress.

Rise of Nations sets limits on city growth, forcing players to establish other settlements to expand. Despite being a little overwhelming at times, the system works well and avoids mad rush tactics. Troops operating outside their national limits are slowly eroded, discouraging continuous assaults in favour of development and encouraging alliances. Conquer the World mode builds on Big Huge Games' more measured approach, letting players concentrate on broad strategic decisions before going to battle.

Resource management is well balanced between hands-on control and automation. The basic resources of metals, stones and timber are supplemented by a simple trading system, and civilisations tend to 'self-develop' within their epoch without too much prompting. Advancement to future ages is a different matter, as players must keep a close eye on the research and resources needed to move forward. Electricity and oil play a big role in later ages, with refineries and power plants providing key targets once things hot up.

Each civilisation brings a small number of special units and national attributes. The national flavour carries on through the ages, reflected in unit markings and structure design, but the rapid rise in technology means it probably has less impact on the game as time progresses. That said, gaining a technological edge over an opponent can bring a devastating short term advantage – attacking stone walls and catapults with M1 tanks and jet aircraft makes for an interesting afternoon! The mix of units looks bigger than it is, thanks to a solid upgrade system, but it ultimately includes ballistic missiles, aircraft carriers and nuclear weapons.

Rise of Nations manages to stand out from the current RTS glut by bringing a few new ideas and first-rate presentation. The pace of the game is quicker than most, and players will be impressed by how much can be covered in a few hours of play. The epoch system works well, with economic and cultural development having a major impact on game outcomes, and it's great to move from knives to nuclear weapons in such a short space of time during multiplay. The marketing hype is excessive – particularly regarding Conquer the World – but Rise of Nations is a strong title that won't disappoint.

8.5/10

GAME DETAILS

REQUIREMENTS: 500MHz processor; 128MB RAM; 800MB hard disk; 16MB DirectX video card.
DEVELOPER: Big Huge Games www.bighugegames.com
PUBLISHER: Microsoft www.microsoft.com/games
DISTRIBUTOR: Microsoft www.microsoft.com/games
PRICE: $99.95
PHONE: Microsoft Games (02) 9870 2200

O: Looks great; fast progress through the ages; and some nice twists to the RTS formula.
O: Nothing really new in multiplay; basic RTS gameplay elements are unchanged; and things can get very complex very quickly.

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Midnight Club II <<<

John Gillooly finds a new use for nitrous oxide.

Once you aquire yourself a motorbike, cars will always be too slow to show.

There's a turn coming up. You can't see it yet, but you've seen it before. 121 times before.

While it has the appearance of a supercharger, it's actually a supercharger.

Arcade racing game. Stop cringing, we know this genre of gaming has been marred by patchiness over the past few years, and slid into the background with the Gran Turismo-driven focus towards 'real' driving games. But with EA's recent revitalisation of the Need for Speed series and Rockstar San Diego's Midnight Club II, there is a small glimmer of hope.

Based around the popular underground pursuit of illegal street racing, Midnight Club II is essentially Rockstar San Diego's second attempt at this title. The original was by no means great, thanks to last-minute removals of key aspects such as motorbikes and the entire city of Tokyo.

Thankfully the graphics engine remains essentially the same but the developers have delivered a more complete gameplay experience. Like all good arcade racers, there is a focus on speed with this title, which makes for fast gameplay and some truly insane driving. Action takes place over a series of real world-based but artistically condensed cities, starting in Los Angeles, progressing to Paris and finally Tokyo.

In the career mode you have to cruise each city searching for other racers, when you spot them a quick flash of the headlights signifies your desire to race them and win their pink slips. While this 'cruise' portion of the game lets you travel all over the cities, the actual races are set in stone and are triggered once you follow your opponent to a predestined start point.

Races vary from simple 'avoid the cops' free for alls to non-linear checkpoint dashes to set races through the city. Usually you end up racing against five or six cars, and you always need to come first in order to progress. Unfortunately the non-linear nature of the races has it falling into a tried and true gameplay trap; trial and error.

Enemy racer AI can be brutal at times, which means that while one stuff up in a race may be recoverable, more than one has you jamming the start button and trying again. The more difficult races consist of trying to learn the track at high speed while staying ahead of the pack. In other words: you race until you miss a turn, then restart and hope that you remember where the turn is. Then you race until you make that turn, miss the next one and repeat the process until you win.

It isn't frustrating for the most part, but it gets annoying when you need to race through dozens of checkpoints to beat the top racer in town. The corollary to this is that when you do win the race there is a warm fuzzy glow of satisfaction that comes from knowing you just pulled out the perfect race.

The action is not just confined to the four-wheeled variety. You can also win motorbikes, which are faster and much more manoeuvrable than the cars. However they can be a bitch to control, and the slightest tap from a passing car will have you tumbling through the air. Get the bike control right though, and it is hard to go back to the cars no matter how fast they are.

Besides cruise mode there is also split-screen multiplayer and online play through the PS2 network adaptor that is still far from an Aussie release. Unlike last year's Auto Modellista from Capcom that suffered horribly from the lack of online support, Midnight Club 2 has a broad enough single player experience to compensate.

Despite minor tweakage to the original graphics engine, Midnight Club II still looks rough around the edges. Textures and models are competent but not outstanding, and the occasional flashy effects seen when you send a streetlamp flying seem out of place among the generally dark, drab environments.

The key benefit of Midnight Club II is that it maintains a good frame rate despite the often chaotic mess of traffic onscreen. This combines with the hugely exaggerated car physics to make for a fun and frenetic driving experience, even when riding semi-airborne at ball-gripping speed after burning the nitrous.

Midnight Club II is a solid game kept from greatness by the sheer difficulty and the fact that online play is still a while off. Hardened gamers who love the challenge of getting things just right, and are not afraid of replaying a race over and over will get the most out of Midnight Club II; others may just get scared by the difficulty.

8.5/10

GAME DETAILS

DEVELOPER: Rockstar San Diego www.rockstarsandiego.com
PUBLISHER: Take2 Interactive www.take2games.com
DISTRIBUTOR: Rockstar Games www.rockstargames.com
PHONE: Take2 Interactive (02) 9482 3455

O: Fast racing action; challenging gameplay; strong single player; fun car physics.
O: Very difficult at times; replaying levels can get tedious; currently no online support.

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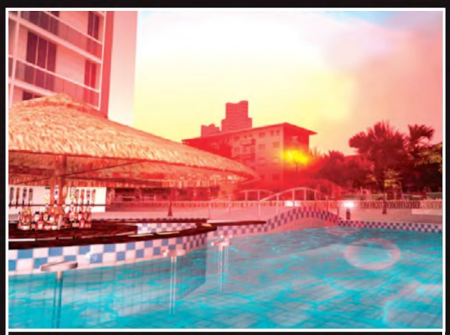
Grand Theft Auto: Vice City <<<

John Gillooly enjoys one of the best console to PC conversions of recent years.

The key to Vice City's splendifery is the hyper-realistic graphicery.

Bikes are one of the big differentiators between Vice City and GTA3.



Don't expect to reach the bar – Tommy still can't swim for floaters.

Already considered one of the finest games ever made, Grand Theft Auto: Vice City blew away the competition in last year's Christmas game sales race and permeated pop culture like few games have. Nintendo attributed low sales not to competition from Microsoft's Xbox, but due to this title from Rockstar Games that delivered the mature gaming experience that many of us crave.

For those unfamiliar with the Vice City storyline, you play Tommy Vercetti (skillfully voiced by Ray Liotta), a mobster who has just been released from jail following a long stretch done to protect his bosses. As a reward he gets sent down to Vice City to move a little cocaine and build up a criminal empire away from the limelight of Liberty City. As the game progresses Tommy gets sucked into the seedy gangland underbelly of the town, working with everyone from the Cubans and Haitians in the slums of Vice City to the high flying property developers and drug lords. The storyline is strong but not restrictive, and Rockstar North has managed to combine freeform gameplay with story-based progression through the game.

Vice City on PS2 is a bona fide masterpiece, and the arrival of the title on PC has been eagerly awaited, although with a degree of trepidation thanks to the half-arsed attempt that GTA3 for PC was. GTA3 suffered from poor frame rates, loads-o-bugs and a console feel. Despite this, it hooked many a jaded gamer with its mature storyline.

Well, it is time to offer up a huge bowl of fruit and virgins to the gaming gods, because Rockstar North seems to have taken this criticism onboard and delivered a PC version of Vice City that leverages all the advantages of the PC without making it feel like the late arrival of a console game. There are some minor, but very welcome, additions to the PS2 title, but essentially this is an accomplished reworking of the original.

The main additions are a new radio station that plays any MP3 files that you throw into one of the game's subdirectories and support for new skins for the game's hero. These are fun, but only the MP3 station really adds to the game experience, even though the soundtrack already has everything from *Reign in Blood* by Slayer to *Billy Jean* by Michael Jackson, all eighties musical tastes are catered for.

Vice City on PC really excels in the graphics department. For the most part the game is free from the bouts of chugging that marred GTA3 on PC, with annoying slowdowns only really happening when helicopter downwash gets a little close. Of course, this usually happens when you are escaping from a very pissed off local constabulary and hence it can be frustrating at times, but for such a graphically rich game, a small issue like this pales into insignificance.

There is a distinct visual style to the game, drawing from the neon-lit tropical hell hole that is eighties pop culture Miami. There is a hyper-real feel to the city, unlike the generic metropolis of Liberty City that provided the location for GTA3. It already looked good on PS2, but at high resolution and with better textures the game looks fucking amazing.

PC controls also bring more to the game in some areas, although for vehicle control the PS2 Dual Shock 2 is still the better choice. By using the keyboard and mouse however, the 'on foot portion' of the game opens right up. Rockstar North put a lot of effort into the PS2 version to improve aiming and auto-targeting from GTA3, but this is irrelevant once you get the smooth targeting action that only comes with a mouse.

The one big control issue is the horrid keyboard layout for helicopters. It works okay when you are in a full-size chopper but for the ultra-twitchy remote controller chopper that is a big part of the 'Demolition Man' mission it is painfully frustrating. At least there is only one mission that is marred by this fiddlyness.

Rockstar North has managed to deliver for PC gamers the same amazing and immersive gameplay that makes Vice City such a PS2 classic. And it has done it by playing to the relative strengths of the PC platform. Smooth, colourful and classy – it is every bit as good as the PS2 version, and is a title that no game lover should miss.

HOT atomic MAXIMUM POWER COMPUTING

9.5/10

GAME DETAILS

REQUIREMENTS: 800MHz CPU; 128MB RAM; DirectX 7 or greater video hardware; 1GB HDD.
RECOMMENDED: 1.5GHz CPU; 256MB RAM; DirectX 8 or greater video hardware; 1.5GB HDD.
DEVELOPER: Rockstar North www.rockstarnorth.com
PUBLISHER: Take2 Interactive www.take2games.com
DISTRIBUTOR: Rockstar Games www.rockstargames.com
PHONE: Take2 Interactive (02) 9482 3455

O: High resolution graphics; non-linear, compelling gameplay; strong storyline with high quality voice acting.
O: Damn helicopter controls and the occasionally slow frame rates.

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CI/A30

ISA is the enemy

Two makes one. Mathematically, no, but take two pieces of one whole piece, and together they make a piece. Singular. It's all fix-related, and the Grand Master of Fixification is Daniel Rutter. We'll let him get to it, in the meantime, IOOTM will score themselves an all-wholly MX700.

IOOTM:

How cold is too cold?

I'm buying a new HSF (Zalman 6000CU) soon and was wondering what to do with my old one. After reading the latest issue I've decided to whack it on my GeForce3 Ti500 and overclock until it bleeds. Anyway, this extreme cooling got me wondering whether hardware can be too cold. We all know that a CPU fries when it gets too hot, but can a CPU freeze and refuse to run if it gets too cold?

Joel Daniels

ABOVE: **You'll need at least two of these a day, to run an LN2-cooled PC.**

Yes, it's possible to over-cool a CPU, but only in a cryogenics lab. Even then, some other important part of the computer is likely to die by misadventure before you manage to freeze anything into non-functionality.

Ordinary computer chips, including CPUs, will function perfectly well at *very* low temperatures. Many extreme overclockers have used liquid nitrogen (boiling point at sea level: 195.8 degrees below zero, Celsius; that's 77.2 degrees above absolute zero) to cool CPUs, generally with the assistance of very temporary improvised rigs involving polystyrene foam cups and quantities of gaffa tape.

This is no way to run a computer for any length of time, but it *is* a good way to determine what the maximum overclock the CPU can manage is when temperature is not a factor.

When cooled like this, CPUs aren't actually running at nearly-200-below; they're sitting in the middle of a storm of boiling nitrogen at some hard-to-determine temperature. No motherboard or in-chip thermal probe can be relied upon to give you a good reading this far out of their intended range, but it's safe to say that LN2 on a processor *will* keep it a long way below zero, provided you keep it topped up.

In the real world, cryogenic computing becomes very difficult very quickly, for several reasons. You either need perfectly dry air around the computer, or you need to waterproof it thoroughly, because condensation is going to be a serious problem whenever the whole board isn't below zero. Condensation and ice crystals inside hard drives (which aren't sealed; they have vent holes with dust filters) are a Very Bad Thing; all of your drives need to be away from the cold area.

Various people have tried long-term cryogenic computing using Eskies and converted fridges and mineral oil immersion and other tricks; something usually ends up rusting or fracturing or delaminating. The CPU generally survives.

Water cooling systems are much more practical. A decently implemented sealed pump, water block and radiator arrangement will cool a CPU a lot better than any air cooler can manage, won't need much maintenance, and should be pretty quiet, too. A good water cooling setup will also generally get you within about 10% of the maximum overclock the processor's capable of with LN2 cooling. The effort needed for really extreme cooling does *not* match the speed improvement you get.

Up a certain creek

One day I turned on my PC, and while I was waiting for it to start I got that 'oh no' feeling – the feeling you get when the message 'Cannot find x please locate the file' or something like that flashes up.

After many minutes of swearing I decided to put my hard drive in my other PC, and it found it OK, but when I explored it I only found one folder and two files. I then ran Norton Disk Doctor and did a scan; it found most of my files, but they were all unorganised and had names like DIR00000 all the way through to DIR00136. Most of the files were 0kb.

I really want to get my files back as I have a Website to maintain and about 15GB of games and keys for my shareware that I have registered.

Is there a program that can fix it?

Justin Soldat

Sorry, but you're boned. Your hard drive might just have had a major file system conniption and not actually suffered a hardware failure, but your data is still functionally unrecoverable. This is the experience that teaches you to make backups. Remember this mantra: If it's not backed up, it's not data you want to keep.

io@atomicmpc.com.au

Tonight, on "Which Solvent?"

I Much inspired by good ol' Ronny Prouse – I can call him "Ronny", can't I? – I decided to cover the hole I was cutting in the side of my Lian Li PC70 with a custom-cut pane of 4mm glass. The window hole I cut was almost identical to the one Mr Prouse cut in the 'Heavy Water Project' in *issue 18* – (unimaginative copy-cat!) – kinda in a 'P' shape.

I also fixed this glass to the Aluminium side cover with silicone as Ronny, his glazier and my local glazier all suggested and/or confirmed as the best idea for this particular adhesion. Fair 'nuff, said I, until the panel lost balance while I was working on the PC and the glass broke.

To quote Mr Prouse in *issue 18* '. . .I was convinced into trying silicone instead. Considering it would be easier to remove if the glass ever shattered. . .'

I've tried all manner of spirits from acetone to petrol to soften that crap, but the silicon isn't going to give before the expensive Aluminium side panel does. The two surfaces are too close to get any kind of blade in under there, and even if I did, the hooks and rolled edges on the panel interior aren't going to allow much working room.

So, please, any suggestions? How the hell do I get that broken glass off my side panel that I spent so much effort into cutting out?

Bacchus

O The solvent usually recommended for cured silicone is 'sandpaper'. But you can do better, if you have a bit of time and the materials involved aren't too touchy – which they're not, in this case.

Ordinary silicone is not petroleum-proof. It doesn't dissolve instantly when petroleum products touch it, but it *will* come apart eventually. So if you put the case-side in a shallow tray of some sort and pour, say, petrol on it, then leave it for a week or two, the silicone ought to just fall apart. Briefer immersion would probably be adequate; I haven't done scientific tests, beyond accidentally destroying a silicone rubber exhaust coupler for a model car some years ago.

Pretty much any petroleum product should work for this. Kerosene or light oil, for instance, not to mention various thin solvents of varying levels of ferocity. Heck, Vaseline will eat

silicone, but a thin liquid is better if you want it to penetrate.

Once you've removed the glass and the silicone, you'll need to give the panel-side a good scrubbing with detergent to get rid of the petrol residue, but then it should be ready for your next attempt.

There are some brand-name products for this purpose as well – DAP's 'Silicone-be-gone' and 3M's 'General Purpose Adhesive Cleaner', for instance – but they're not likely to be easy to use on a sandwiched film of silicone.

Temperature panic

I I recently discovered that my Athlon XP 2000+ was running a little hotter than I would like it to. At restart it was about 54 degrees Celsius (this is the supplied cooler). Then I checked it with the supplied mobo monitor utility after playing UT2003 for an hour or two only to discover that it was running in the 70 degree area.

I panicked. This was far too hot for my (shamefully) unoverclocked 2000+. In your latest issue I noticed in your Hot Box section that Axeman's Gothosaurus was running the same chip overclocked, at almost half the temp.

I have now investigated the possibilities of cooling and considered buying a Peltier, coupled with a Volcano 11. Is this insanity? What do you think the most effective solution is, and what risks are involved (this is of course excluding the luxury of VapoChill and water cooling, mainly because I can't afford them)?

Alex

ABOVE: Peltier devices can make ice easily, unless they're loaded up with a CPU's heat. . .

O My standard answer to questions of this type is: Does your computer crash?

If the answer to that question is 'no', then you don't really have a problem.

Not *yet*, anyway.

It's possible for cheaper thermal transfer material to deteriorate, resulting in steadily climbing CPU temperatures that can eventually leave you with a flaky PC. If the temperature when you're doing some particular task isn't getting higher and higher as the weeks go by, though (remember to account for ambient temperature – if today's 25 degrees Celsius and yesterday was 20 degrees, you can expect your CPU temperature to be five degrees higher today), then there's probably nothing to worry about. If the CPU temperature *is* climbing, then taking off your CPU cooler and re-greasing the contact patch, preferably with a premium thermal grease that won't dry out, will probably deal with the problem.

Numbers from motherboard temperature sensors are unreliable. Under-chip sensors commonly vary from board to board, depending on how firmly the sensor's touching the chip, if it's touching at all; the sensors *inside* current processors are more accurate, but can still be badly calibrated. BIOS updates can and do change CPU temperature readings, by changing sensor calibration. So your '70-plus degree' CPU temperature readings aren't necessarily accurate, anyway.

Again – if it ain't crashing, don't worry about it.

If you're using a stock cooler at the moment, and you'd like to cool your CPU a bit better, then a Volcano 11 is a perfectly good option for the money. Steer clear of the heat pumps

though. Peltier devices are very difficult to get working properly.

Considering your processor can output about 70 watts when working hard at stock speed, you'd need a Peltier device that can shift that much heat to a CPU cooler, while maintaining a decent temperature differential between its two sides. This means a *high*-power Peltier, or an inelegant parallel-Peltier arrangement with a giant cold plate.

You'd probably need a separate power supply for the Peltier(s), and you'd also need to condensation-proof your CPU socket and the motherboard behind it, or use a thermostatic control that'd keep the CPU above the dew point when it isn't working hard. And then you'd probably want some automatic shutdown system or other, to save the CPU from burning up if the Peltier or its power supply should fail. It's all just too much trouble, if you ask me.

NTLDR not found. Use NTCRSHR?

I was running Win98SE and wanted to upgrade. I brought another hard drive, installed it as a slave, formatted with Seagate Disk Wizard, and then installed XP (NTFS) on it, and transferred the files I wanted to keep from the 98SE disk.

I want to run the XP drive as the master, and format the 98SE disk to use as a backup disk. But have found that if I change the jumpers on the drives, the BIOS settings, or disconnect the 98 drive, I get an "NTLDR error".

Is there any way of fixing this boot error without reformatting my XP disk?

Iain Calder

NT-series Windows versions, including WinXP and Win2000, can't *really* be installed on any disk other than the one you boot from. Well, not without help from outboard boot manager software, at any rate.

If you tell XP to install on D:\, practically everything *will* be installed there, but the loader – NTLDR – will be on the boot drive. Remove or re-letter the boot drive and NTLDR can no longer be found.

If you swap the drives over and then boot from the XP CD, you should be able to use the 'repair' install option to make the existing installation work, without having to nuke it from orbit and start again.

Duron de-dotting

I have a 1.3GHz Duron. Its usual temperature is around 50 degrees+ on a normal day! I know AMD processors usually run warm, but the fan is quite loud and frankly I'm going insane!

I have come to the conclusion that I need to improve the cooling in my case and on the CPU as much as possible. I'm wondering – is it OK to remove the little foam pads on the processor? Will this increase the contact with the CPU causing more efficient cooling, or will I cause irreparable damage and be left with 'an expensive paperweight'.

Douglas Fisher

Point one: Dead CPUs make very poor paperweights. They are, however, popular as key-chain ornaments, and if you push hard enough you may be able to use them to hold a document to a corkboard.

Point two: Don't remove the rubber dots. They're there for an important reason.

The dots on the top of Socket A CPUs (AMD calls them 'Compliant Load Support Pads') are there to stop the CPU cooler from crushing the core. You're most likely to damage the core by tilting the heat sink while you install it; the rubber dots stop it from tilting too far. They don't greatly reduce the contact pressure between the CPU and the heat sink.

ABOVE: You *could* use a Peltier/fan combo to cool your system, but it's not really that efficient. Stick to waterblocks and big fans like this one.

Some people remove the dots and install a metal shim instead, but the only vaguely coherent reason to do that is so that you can use an extremely high pressure bolt-mount cooler.

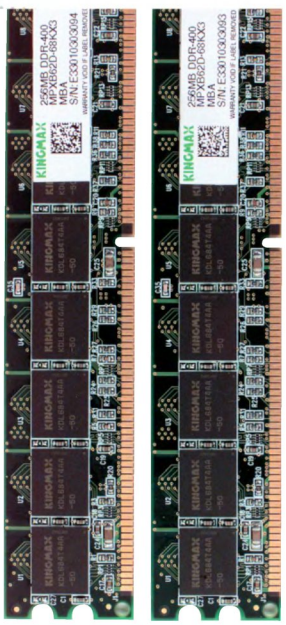
All other things being equal, swapping the dots for a shim makes no difference to anything but your bank balance.

RAM + RAM = HANG

Hi. I have just purchased 512MB DDR266 to add to my current 256MB (which is also DDR266). The 256 works fine by itself, the 512 works fine by itself, however when I try them together to give 768MB (my original intention) there is major system instability. The 256 is a Synnex stick, the 512 is an Elixir. The motherboard is an ASUS A7S333 with an Athlon XP 1600+, running Windows XP Professional.

Simon Sillitoe

Welcome to the wonderful world of memory incompatibility. It's common enough, especially when trying to make two budget memory modules work together effectively.



ABOVE: It's RAM! And two sticks of it! Make sure they work!

It's also possible that one or both modules are damaged (probably by static electricity), but problems like this arise quite often with cheap RAM, even when they have never been mishandled.

You can try installing the modules in different memory slots, but that's not very likely to help. If you try to get a refund, you may find it difficult, since the retailer can just insist the old module must be the source of the problem, or that any damage must be your fault.

To be fair, it often *is* the customer's fault; many people simply don't realise that just taking two steps can be enough to build up a tiny static charge, and it's enough to damage a sensitive RAM module.

Take some time to think about all the stuff you've ever tweaked, tweakified and tweakibroked. While you desperately try to plug the flood of geared-up gizmos and failed fans that cascade into your brain, Simon Peppercorn throws some more tweaky tips your way.

Don't 'Start' with me.

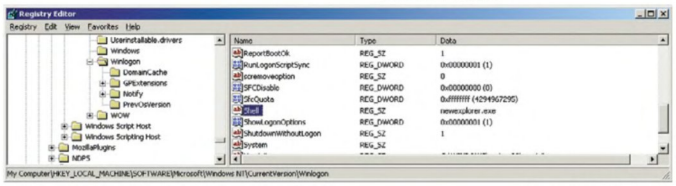
After more than eight years, the Start button is looking somewhat passé. It's about time we modded it. Let's do it.

There are various ways of doing the deed. You could jump into your favourite hex editor and change the value. You'll be limited to five characters though. Which is lame, because '*Atomic*', just for example, has six characters. So we need to find a different way.

Yes, hex editing is hardcore and l337 to some kiddies, but better results can be achieved if you get yourself a copy of 'Resource Hacker' from www.users.on.net/johnson/resourcehacker. When you have downloaded it (only 538KB) extract, install and run it.

The file we are interested in is C:\Windows\explorer.exe. Before you start, make a backup up of the file. It is kind of important you do this if you want to see your Windows desktop ever again. For this project, the best and safest way to do this is to copy the explorer.exe file into the same directory, and rename it something like newexplorer.exe or similar. Then through your registry, change the value of the [HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon] 'Shell' key to reflect your new explorer.exe filename (see picture).

Start Resource Hacker and open newexplorer.exe, or whatever you named it. Browse through the directory on the left until you find the string table for the 'Start' button text. When you have it, jump in



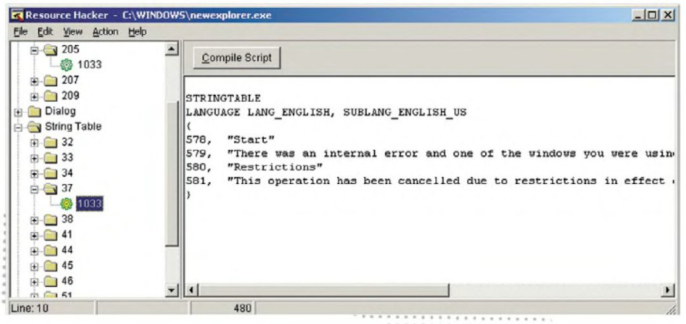
and change it to something cool. Then, compile the script, save, and reboot. See, you don't need a stinking hex editor for this!

Now, if it all goes to crap, and your new Start button has screwed with your Desktop, jump back into regedit, and change back to your original explorer.exe. Although, if you killzOred your Desktop completely – as I managed to do by not carefully typing in file names – you can still get to regedit by doing the Ctrl+Alt+Del combo to get to Task Manager. Start a new task (File -> New Task -> regedit) then change the setting back to your original explorer.exe. Lucky you backed it up, right?

Registry tidying upOring

Over time, as applications are installed and uninstalled, your registry can become fragmented and cluttered with redundant keys, making it a whole lot larger than it needs to be. This results in increased boot times and slower system performance.

The defrag utility won't help you, because the fragmentation is



internal to the DAT files which make up the registry. There are third-party utilities, which do a great job of defragmenting the registry and removing clutter and errors. But here are some steps you can take which should help bring about some order to those damn pesky registry files.

First, download and run regclean to fix errors in the registry. If you don't have regclean, download from http://download.com

Restart into Safe mode with command prompt and make copies of system.dat and user.dat (your registry files) into a different folder. While you are here, remove the hidden, system and read-only attributes from the system.dat and user.dat files, then type 'regedit /c oldreg.txt', (depending on stuff like system speed, size of your registry etc, this could take a while). When it's done, reboot.

If you have problems after this, then go back to Safe mode with command prompt and replace the registry files with the ones you backed up.

Changing your 'Outlook' on life

'Drexxle' sent us this handy tip to control the way Outlook opens.

Create a shortcut on your desktop for your Outlook.exe file, which should be found in C:\Program Files\Microsoft Office\Office. Right click on the shortcut and open its Properties page. In the target box, leave the path intact, but put a space at the end and use one of the following parameters: (make sure you include quotations if applicable)

Select C\"folder name" (and open with folder name as the default folder)

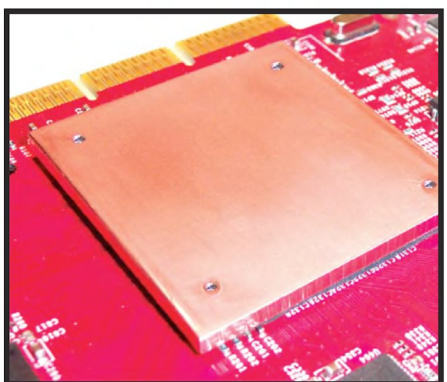
/c ipm.note (to create new email)
/c ipm.post (to create new post)
/c ipm.appointment (to create new appointment)
/c ipm.task (to create new task)
/c ipm.contact (to create new contact)
/c ipm.note (to create new sticky note)
/c ipm.activity (to create new journal entry)
/checkclient (to prompt for default manager)
/a "path/file name" (create an item with the specified file as an attachment).

Phrozen FX

Excuse the l337 speak – it was very cold and artless of us. Still, you can't pardon away the sleet appeal of strapping some coolness to your video card. It sure has Ron Prouse shivering in delight and his eyes leaking cloud juice.

1 The assumed prerequisite for this mod is to have a video card with the four holes around the perimeter of the GPU – to aid in the mechanical 'attachment' of the cold-plate. The same process can be achieved on any processor by using thermal adhesive, however that will mean that everything is permanently attached, and the lifespan of the video card will be determined by the longevity of the other components.

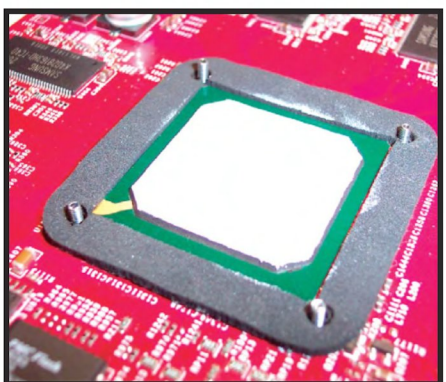
The method used here allows for the Peltier (TEC) and cold-plate to be removed for use on another video card, or for replacement should the card out-live the TEC. The water block is also kept separate, so that the video card can be removed from the motherboard without having to drain the cooling system.



2 Perfect allignment is essential.

The cold-plate is the most important component, and getting the fit right is critical. It must be centred over the GPU, with the four 2mm holes drilled and tapped in perfect alignment with the video card.

Using a drill-press is clearly the easiest method of ensuring the holes are perpendicular on both vertical axes, and help guarantee the cold-plate will screw down onto the processor surface with even pressure.



3 Control condensation hotspots.

Insulating the GPU will help in controlling condensation, and consists of two components: some 3mm-thick neoprene rubber (wet-suit material), which is easily obtained – a 'soft' stubby holder will do the trick; and some non-conductive Artic Alumina thermal epoxy.

The neoprene is cut to form a square 6mm wide 'gland', or gasket, to fit around the GPU and the four mounting holes, which is then attached to the PCB using the thermal epoxy.

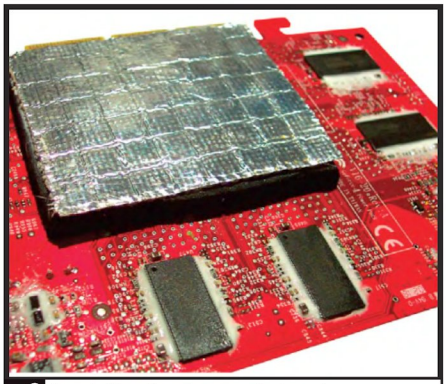
4 Make sure there are no air gaps.

With the gasket now in place, use either dielectric grease or RTV Silicon to fill any air gaps within the enclosure where you think condensation (or ice) could possibly form, making sure to also include the screw cavities.

Unlike a CPU, a GPU is hard-wired into the PCB, so corrosion of connector pins due to moisture is not an issue – the objective here is to prevent water build-up that might trickle off elsewhere with devastating results.

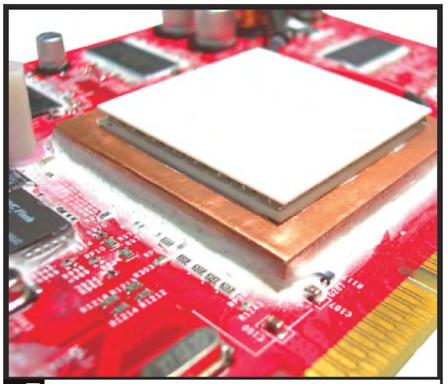
5 Make it firm, but not too tight.

Apply thermal grease to the GPU surface, and attach the cold-plate, making sure to tighten the screws evenly in an 'X' pattern.
Be careful not to over-tighten the screws and cause damage to the GPU die – a touch more than finger tight is all that's required to make sure that the two surfaces are in firm contact.
Finally, apply several thin layers of RTV Silicon around the outer gasket / cold-plate joint.



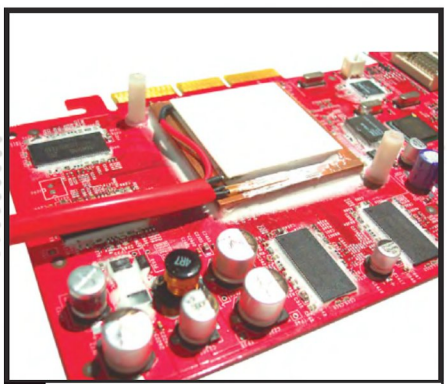
6 Insulation is also needed on top.

The top of the PCB also needs to be insulated, using more neoprene rubber glued on with Artic Alumina thermal epoxy. The rubber should cover all of the GPU connections, and be at least the same dimensions as the cold-plate, or larger. Again, the intention is to eliminate any air pockets that might trap condensation. Any bare connectors, such as the 'legs' of the RAM and BIOS chips, should be protected with RTV Silicon for the same reason.



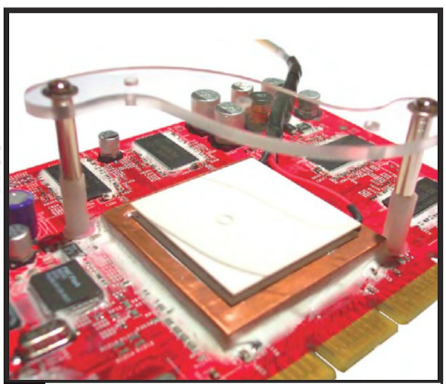
7 Use thermal expoxy to attach.

With the cold-plate secured, attach the TEC to the centre of the plate with thermal epoxy – hot side up! The eight-amp Peltier used here is 'un-potted', so the sides will need to be filled with epoxy – by sealing in the edges of the TEC you are in effect potting it and the life of the unit is extended, especially if it is done under vacuum. If possible, it is better to purchase a TEC that is already potted – Silverprop sell an excellent unit, but were out of stock at the time of writing.



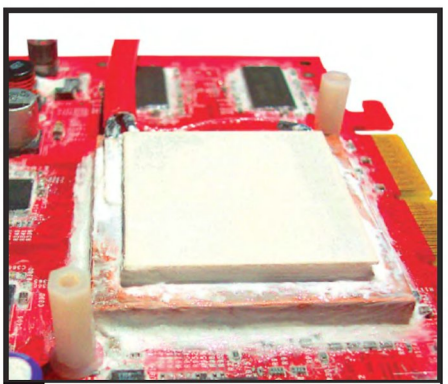
8 Remember the thermal probe.

The TEC wiring needs to be supported and protected, so it has been covered with PVC tubing. As an afterthought, a thermal probe has been glued onto the cold-plate so that temperatures can be monitored during use – in hindsight, a better method would be to glue it to the side of the GPU before assembly, and then route the wires out through the neoprene gasket. As in step six, all exposed connectors and joints should be covered with RTV Silicon.



9 Bolt together water-block brackets.

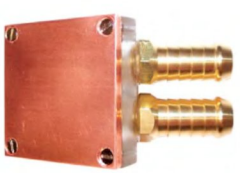
The next task is to fabricate the mounting brackets for the water-block. Using the OEM HSF retention holes is the easiest path, and by using 'long' nylon nuts, washers, spacers and 3mm screws from JAYCAR it is a straightforward matter of bolting it all together.
The clamping-bracket that came with the Pixellce water-block simplified things, however it would be easy to make something similar from either scrap acrylic or Aluminium.

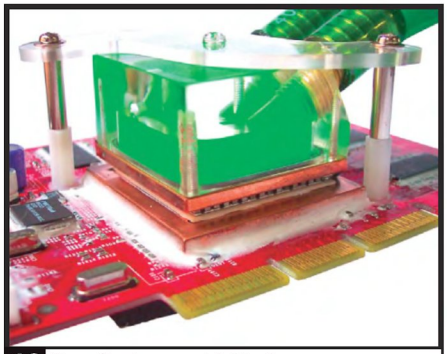


10 Extend the RTV area to 20mm.

After 'potting' the TEC with epoxy, the assembled unit should be given several thin layers of RTV, making sure it is extending out to cover at least a 20mm perimeter from the cold-plate, building the thickness up to approximately 1.5mm. One suggestion – it is much better to err on the side of caution – seal anything that you think might gather condensation, rather than finding out the hard (and expensive) way when the sparks really start flying!

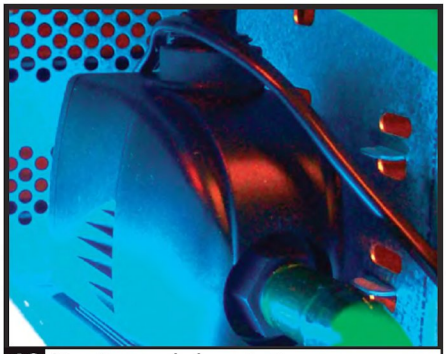
11 With the TEC module complete it's time to prepare the water-block.
The first thing is to make sure that the contact area is flat and smooth, to ensure that there is a good thermal hook-up.
The four retaining screws on the Pixellce water-block needed to be counter-sunk, and the base 'lapped' with #1,200-grit wet'n'dry sandpaper using Brasso as the lubricant.





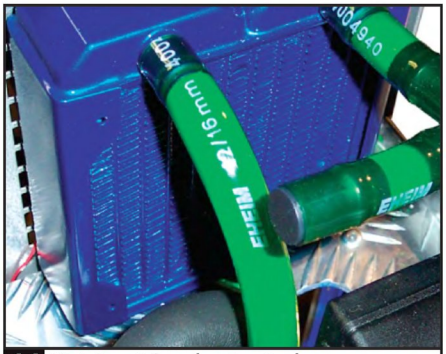
12 Do a 'test assembly' to be sure.

With the water-block ready for mounting, it is a wise move to perform a 'test assembly' as a final check regarding clearance for hoses, wiring, and to make sure that the two contact surfaces fit together correctly without 'fouling' on any of the motherboard fixtures.
It is also a good time to finalise the fitting of the other water-cooling components that the TEC module is going to need to keep cool, and an opportunity to admire just how cool the whole set-up looks so far.



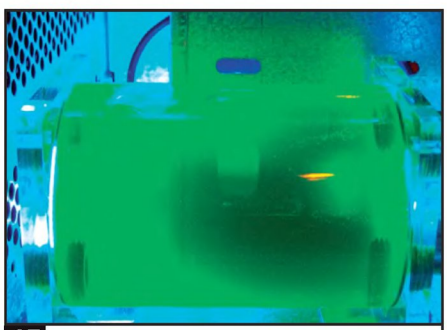
13 'Head' pump is important.

The hot side of the TEC is cooled by a system that is dedicated purely to the video card.
This pump is an inline 'Hygro' brand, which has a 1/2 bore and will circulate 700L/h (litres per hour) of coolant at a maximum head (height) of 2.1 metres. The amount of 'head' that a pump can deliver is important, as it is a direct indication of how much back-pressure (or resistance) the impeller can overcome at a certain rate of flow. More height is always better.



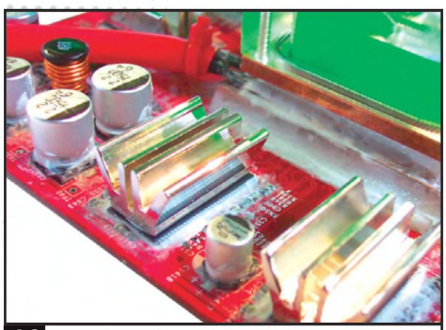
14 Watch out for pipe hardening.

Heat exchange is taken care of by a Black Ice Extreme two-pass double-row radiator, renown for providing low pressure-drop performance while still being rated at 790Kcal (3,134BTU) per hour. Mounted in an exhaust configuration above the PSU, circulation is provided by a 120mm Panaflo fan running at seven volts. 12/16mm Eheim tubing was chosen for its proven resistance to hardening in extreme conditions. The 'T' junction on the right is for filling, and for measuring coolant temperature 'in-line'.



15 Catch the bubbles at the top.

Air bubbles are a proven cause of premature pump failure, as cavitation caused by air pockets in the impeller chamber will force the motor to work twice as hard. The easiest method to 'bleed' the air out of the system is to have an inline reservoir that will trap bubbles at the top, while the pump feed is from the bottom. This provides a constant bubble-free supply of coolant to the inlet manifold, as well as adding extra volume to the cooling system capacity.



16 RAMsinks: important or not?

The final detail for the video card is to add some RAMsinks. Some might question how much effect 'sinks' contribute to overall performance, but my experience has always been positive so on they go! Interestingly, while bench-testing the card before installation, the RAMsink temperatures were eight degrees below ambient. This would be the effect of the TEC on the GPU, 'feeding back' through the copper PCB traces to the RAM chips. wOOt! PCB cold-pipes!

17 22 degress. Not bad.

The left temperature is the coolant reading, the right is the side of the cold-plate as shown in step eight. Ambient air temperature was 18.5 degrees. So, at load the cold-plate is just above zero degrees, and below zero at idle. Small droplets of ice appear over the sides of the cold-plate, however they are not enough to be of concern. Important note: to avoid corrosion and arcing, smear the AGP slot and card connectors with ample dielectric grease during installation.

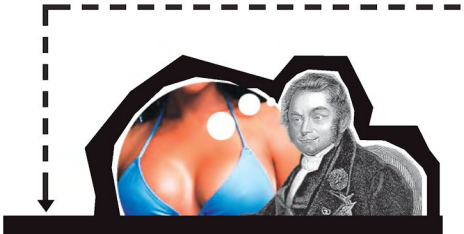
A special thank you goes to the two companies that got behind this project and made it all possible, supplying quality components and sound advice:

PC Case Gear – www.pccasegear.com ph: 03 9568 0932

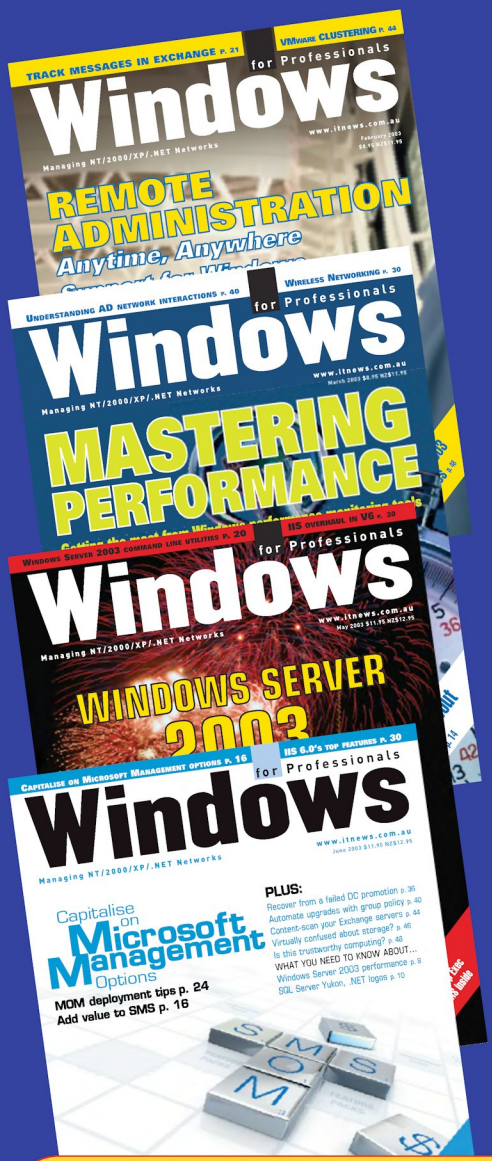
- **PixelIce water block: $59.00**
- **Black Ice Extreme radiator: $159.50**
- **Eheim tubing: $7.00 per metre.**
- **CritiCool WaterPlant reservoir: $49.50**
- **Tweakmonster RAMsinks: $29.70 per four**
- **Artic Silver Alumina adhesive: $22.00**

Silverprop – www.silverprop.com ph: 03 9820 0908

- **Copper cold-plate: $10.00**
- **RTV electrical sealant: $6.50**
- **Dielectric grease: $6.50**



Something astounding happened in 1823. It *might* have been the birth of Ernest Renan, author of *The Life Of Jesus*. It wasn't though; the discovery of Silicon by Jons Berzelius is what we're talking about. Beside causing Silicon disease if used incorrectly, and having a god-awful melting point of 1410 degrees Celsius, Silicon is used these days for computer chips. It's one of those lucky elements that's considered a semi-metal, and being crystalline, it's oh-so-sexy. Just like Jons.



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The Uber-Linux box project Pt5

Penguins starting to looking attractive? Finding those slippery curves alluring – in a half-bird, half-fish monstrosity kind of way? Ashton Mills teaches us to tame and court Linux's inner bandwidth.

This month we have more sexy Linux goodness for you. It's so sexy, in fact, that it's uber sexy. What could we possibly add to your connection and file sharing, firewalling, ad-blocking, stat-graphing and game-serving uber box of joy?

First, some theory.

The shape of things

Even though your pipe to the Net may be a 128Kb/s, 256Kb/s, 512Kb/s or higher, your cable or ADSL modem is capable of more. How an ISP distributes bandwidth among its users, enforces upload speeds, and does nifty tricks like reducing your download rate when you breach your monthly cap is through some networking magic that goes by the name of 'bandwidth shaping'.

Now, normally only routers do this sort of thing. But Linux, bless it, can also act as a router. Why would you want to shape traffic on your Linux box? Well what if, for example, you shaped traffic based on protocols or ports? Say, to prioritise one type of traffic over another? Such as the type of traffic that games use? Have you ever wanted to:

- Play games online while a big download is going, but found it too jerky to play?
- Browse the Web with speed, even while your P2P software is leeching in overdrive?
- Prevent flat mates or siblings impinging on *your* vital bandwidth when you're downloading or playing online?
- Be loved and adored by everyone, everywhere?

Well now you can, and the Uber Linux Box Part 5 will show you how.

The power of packets

When you get down to it, playing with packets is fun. You can shape bandwidth on all sorts of criteria, from the protocol (such as TCP and UDP) and destination or source IP address, through to ports and even the size of a packet. If you can think of it, you can do it.

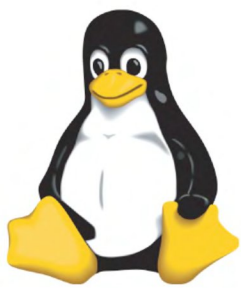
As *Atomic*, we're going to focus on some of our passions – games, file sharing, and browsing. We've built a special *Atomic* Uber Shaping (AUS) script for this very purpose to complement the Uber Linux box, and to help you master the art of playing packets. Use it wisely, for its power is great.

Why your bandwidth isn't

The golden rule to remember when it comes to bandwidth shaping is that you can only shape what you *send*. You can't control what the world sends to you. Even so, in true *Atomic* style, we'll find a way around this a little later.

So here's the deal: in the interest of providing you fast downloads your ISP uses a very large buffer for sending data

WHAT YOU NEED:



1 A box

The first four parts of the Uber Linux box guide can be found in *issues 20* to *23*, so if you don't already have an uber box up and running now would be a good time to start.

Note that while the Uber Linux box guide is based on Mandrake 8.2, you can use it on any distribution. All you need if you want to follow the guide is Samba for Windows file sharing, iptables for the *Atomic* firewall to share your connection and protect your network, Squid to speed up browsing and save on bandwidth, and Apache and mrtg to graph your throughput using the *Atomic* monthlystats script. All of these packages are readily available in most distributions. I have it all running under Gentoo.

This tutorial also can be applied to any box. You just need to install the iproute2 package, which if you're following on from the previous Uber Linux box tutorial should already be installed. If it isn't, **rpm -ivh** the package from install CDs.

2 A kernel

Additionally, whichever distribution you use, you're going to need a 2.4.20 or later kernel. To see which kernel version you are running, login and type: **uname -r**. If you're using the same kernel you installed with Mandrake 8.2, you're going to need to upgrade – so if you so far haven't compiled your own kernel before, now is as good a time as any (and besides, it's a great party trick!).

Grab the latest stable kernel from ftp://ftp.kernel.org/pub/linux/kernel/v2.4 – named at time of writing 'linux-2.4.20.tar.gz'. If you haven't compiled your own kernel before just follow the 'Roll your own kernel' guide in part 4 (*issue 23, page 102*), and pay attention at the end where it mentions installing source from a .tar.gz.

When you're configuring remember to include all the drivers and features you need (**cat /proc/pci** is your friend). Take it slowly, and if you're not sure about something, compile it as a module. Additionally, in order to use gateway/firewalling and bandwidth shaping capabilities, enable the following:

- Under Networking options -> IP Netfilter configuration: compile everything as a module.
- Under Networking options -> QoS and/or fair queuing: compile everything as a module, with the exception of 'Special RSVP classifier for IPv6'.

Don't be concerned if your first kernel build fails to load. It's a huge learning curve for any level of geek. Just look at the error, figure out what you need, and remake it. Once you're confident it works fine you can make it your default boot in lilo. And don't forget Google and forums if you need help – there's plenty of people who know kernel compiling like the back of their pasty hand.

3 The traffic controller

You *may* need an updated version of the TC (traffic control) program. Your distribution might already include this, but there's no harm in being sure (you may get errors later on otherwise. Which is kind of bad).

Grab http://luxik.cdi.cz/~devik/qos/htb/v3/htb3.6-020525.tgz, decompress it in /tmp, and copy 'tc' to /sbin.

down the line to you. Your cable or ADSL modem, also, has a large buffer to help maximise upstream throughput.

However these buffers, known as queues, become problematic when it comes to interactive applications. If you set off a download and then try and use your link for anything that requires fast response times, such as online gaming, these queues – filled by the fast download – will cause massive delays

4 The *Atomic* Gateway Kit

Head to www.atomicmpc.com/downloads and grab 'atomic-kit.tar.gz'. This includes not only the AUS script but also updated versions of the *Atomic* firewall and monthlystats. Read the README for a list of changes to the programs.

Decompress the archive and copy both 'atomic.firewall' and 'atomic.shaper' to /etc, editing atomic.firewall first to suit your network (remember to uncomment HTTP forwarding if you're using Squid) and move across any changes you made to your current version.

Run /etc/atomic.firewall and make sure everything is working as before.

When you've done these steps, you're ready to proceed.

while packets wait in line. For the download, this doesn't matter. For realtime applications, this is a killer. Responsiveness drops through the floor, and what was a 50ms round-trip becomes 350ms and littered with burst spikes.

So how do we shape bandwidth to prevent this from happening? The first step is to move these queues from the ISP and modem to your Linux box where you have control. Once they reside safely on the Linux box, you can do whatever you like with them.

Doing this is actually quite simple – set bandwidth caps on the Ethernet card connected to your cable or ADSL modem that are *just* under the maximum bandwidth of your link, and the queues in the modem and at the ISP disappear. The rate of flow will no longer be higher than the rate of your bandwidth, and so the queues no longer fill up. Then it's just a matter of making your own queues on the Linux box and re-ordering packets to suit your needs.

Didn't I say this was going to be sexy?

Right on queue

Before we begin, let me introduce you to some queues you didn't know you had. Telnet or SSH into your box and run: **ip link list**.

Every Ethernet device comes with a default queue that, in routing parlance, is known as a queuing discipline, or 'qdisc'. You'll see that the default qdisc is 'pfifo_fast', otherwise known as the 'priority band first-in first-out (FIFO) queuing discipline'. We'll get into priority bands a little later, but in short the pfifo_fast qdisc recognises and respects TOS (Type Of Service) bits attached to packets. TOS bits include settings such as 'minimise delay', 'maximise throughput', and 'maximise reliability' and can be set by network aware programs. For example, SSH under Linux automatically marks packets as 'minimise delay' so that any router along the way (such as your Linux box) will prioritise these packets above all others, even in the simple FIFO queue.

Your Linux box has already been maximising the efficiency of your connection!

The problem with this queue, however, is that it's very straightforward and we can't play with it. If we're going to shape, we need to replace it with something more versatile.

So how do we replace this simple qdisc with one of our own design?

The flow tree

Before we install a new qdisc it helps to map out what we want to achieve.

There are two other parts to the qdisc equation – 'classes' and 'filters'. Think of classes as qdiscs that represent different types of data you want to classify, and filters as the selection criteria that physically grabs the packets and puts them into the right class ready for sending.

Every device must have at least one qdisc, the 'root' qdisc. To this can be attached multiple qdiscs which can be standalone or act as parents from which further qdiscs can be attached. This way you can separate and sub-divide your bandwidth into any sort of hierarchy.

For our requirements we want to shape bandwidth into three classes: gaming traffic as top priority, followed by Web (for browsing) and other interactive traffic (like SSH), and lastly a bulk class for everything else. We also need to attach these to a 'parent' qdisc that can be used to 'group' the three classes together, enabling the sharing and management of bandwidth across them all.

You can see how this works in figure #1.

Linux provides us with a variety of qdiscs and filters we can use to accomplish our task, so lets look at what we need.

Queuing disciplines

Qdiscs come in two forms – classful and *classless*.

- **Classful** qdiscs are those which can themselves support other classes (sometimes called bands) and include CBQ (Class-Based Queuing), HTB (Hierarchical Token Bucket) and PRIO (Priority band).

CBQ and HTB are both capable of shaping bandwidth across multiple classes with priority and rate limiting. PRIO, by comparison, is more like a souped-up pfifo_fast qdisc and while it can prioritise bandwidth among classes, it can't really throttle them. PRIO is particularly useful when all you are after is simple priority management.

- **Classless** qdiscs are, as the name suggests, unable to support child classes and often form the end point (leaves) of your flow tree. Classless qdiscs include the default pfifo_fast, TBF (Token Bucket Filter) and SFQ (Stochastic Fairness Queuing). TBF is a basic FIFO queue that has the extra ability of being able to rate limit much like CBQ and HTB. If all you want to do is slow down a link, TBF is ideal.

SFQ is unique in that it doesn't prioritise and can't throttle bandwidth, but instead provides the ability to (stochastically) balance all data streams passing through it. In other words, if you had five programs all sending data at once, SFQ will do its best to ensure each stream gets equal opportunity to send – this is different from a FIFO queue which is, as you'll remember, first-in first-out.

There is also one more classless qdisc which is even more basic than pfifo_fast – it's the simple *pfifo*. Unlike its cousin, pfifo can't prioritise, it's just a plain FIFO queue measured in packets. It bears mentioning here because we'll be making use of it.

Filters

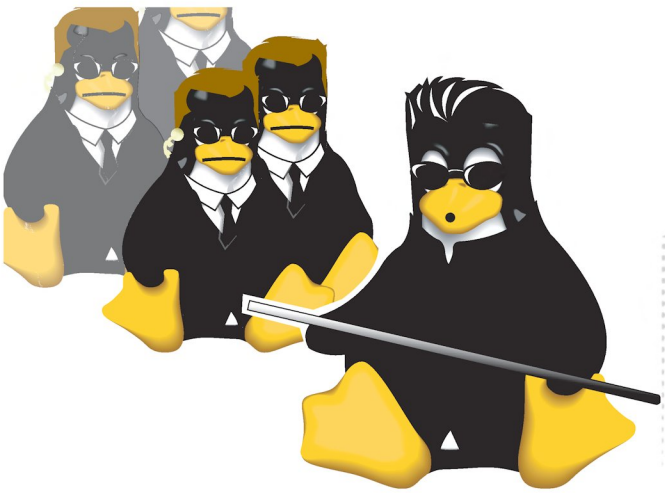
As mentioned earlier filters are used to selectively place packets into their appropriate class, and there are a variety of filters you can use. These include filtering based on routing tables (the 'route' filter), packets marked by a firewall with iptables (the 'fw' filter), and a special filter (called 'u32') that allows you to classify packets based on source and destination addresses, source and destination ports, protocols, and even packet size.

More information about these qdiscs and filters and their associated settings can be found in the Advanced Routing & Traffic Control HOW TO at www.lartc.org.

Shaping, Atomican style

If you've stuck with me this far, you're a hero. Now lets take a look at the AUS script to see what we use and why.

Remember the goal is to shape in such a way that we can set off downloads or leave P2P software running in the background without it having a major impact on online gaming,



Web browsing, and other realtime tasks.

To do this we could use a combination of a PRIO parent qdisc with three child TBF qdiscs – PRIO would provide the priority we need, while TBF would allow us to rate limit the link to ensure the queue resides on the Linux box. And in fact if you can't upgrade your kernel, this is exactly what you can do (since PRIO and TBF are part of the whole 2.4 kernel tree).

However this combination isn't very efficient – being classless, TBF can only act independently. In order to keep control of the queue the total of the rate limits of all TBF classes cannot exceed the capability of your link. This would mean each class can only go as fast as its portioned limit, even if there is unused bandwidth available from other classes.

Enter CBQ and HTB. Both of these classful qdiscs allow for the sharing of unused bandwidth of one class with that of another. This translates to being able to use the full bandwidth of your link while still prioritising traffic. We like this. Between the two HTB is easier to use than CQB and slightly more efficient, and so it's our qdisc of choice.

In addition to using HTB for parent and child classes, we also attach a speedy pfifo qdisc to our gaming class to provide minimal latency, and an SFQ qdisc to each of our high priority and bulk classes to maximise their efficiency.

Shaping upstream

Open up /etc/atomic.shaper in your favourite text editor and scroll down to the section beginning with 'EGRESS'. This is where we set the shaping rules using the traffic control (tc) tool that lets us manipulate qdiscs and filters. The rules can be broken down into the respective sections from our diagram:

- **Root qdisc:** The first command replaces the default pfifo_fast with our HTB qdisc. The 'handle' is an identifier by which we can reference the qdisc, and 'default' the default queue any unclassified traffic should be sent. The '30' is a class identifier we have yet to create.
- **Parent qdisc:** The next line creates the parent HTB qdisc to which we will attach our three classes, and here we set the global rate to throttle the device. The 'parent' value refers to

the handle of the root qdisc. The 'classid', like handle, allows us to reference the qdisc so we can attach child qdiscs.

- **Child qdiscs:** The next three lines create three HTB classes of lowering priority (numbered 1 to 3). Here's where we do our real shaping.

Firstly note each class has its own 'rate', together totalling no more than the rate of the parent. The rate represents the desired guaranteed speed for a class if the link were saturated. At other times each class can reach up to its specified ceiling by borrowing unused bandwidth from other classes.

These are important values. You'll see that we give our gaming class half the link, even though most games won't use that much. What's important is that if they needed to, then it would be there for them. The rest of the time any unused portion is automatically assigned to other classes by the parent.

The ceiling is also important. Normally you want this to equal the parent qdisc ceiling, but in the AUS we cap our bulk class to about 60% of the link.

While HTB does a great job shuffling the bandwidth around, it can't guarantee an uninterruptible stream. Setting a limit on the bulk class provides room for the gaming class to run uninterrupted while uploads are in progress.

For the same reason we also specify low burst rates for our bulk class. Bursts are the maximum amount of information that can be sent in one go. High bursts equal good transfer speeds, but can cause 'spikes' in throughput of the qdisc.

By setting low burst values for the bulk class we minimise the impact of these spikes. You can halve the 1Kb value if you wish to create an even smoother stream, with only a minor reduction in upload speed.

It's worth noting that for all but online FPS games, HTB's default allocation and burst rates work just fine. The above tweaks are specifically to support smoother gaming in FPSes where a clean stream is vital. Additionally, these tweaks are mostly to provide clean *download* streams. See the sidebox 'The law of ACKs' to understand why.

Lastly, you'll note our bulk class is given a 'classid' of 30, the default class referenced by our root qdisc at the beginning.

- **Leaf qdiscs:** Though not shown on the diagram, we attach qdiscs to maximise the efficiency of each class – a clean, fast pfifo for our gaming class, and two SFQ qdiscs for high priority and bulk for the multiple streams they will handle.
- **Filters:** All that remains is to add the filters that classify packets. We do this in the *Atomic* firewall as its easy and keeps all packet manipulation in the one script, but we still need to look out for the marked packets by using the 'fw' filter.

And that, essentially, is our shaping script. Now open up /etc/atomic.firewall and scroll down to the 'BANDWIDTH SHAPING' section.

Each iptables command checks to see if a packet matches our criteria and allocates it to the correct class – gaming (10) or interactive (20) – by mangling (modifying) the packet. In this case, a mark is added that will be recognised by the 'fw' filters. Anything not marked is captured by the 'default' ruling of the root qdisc and sent to bulk (30). The numbers are arbitrary, as long as the values used here line up with the values for the filters in the shaping script.

As most games use UDP these packets are marked for class 10, as are any packets travelling to DirectPlay ports. This should cover most games. We also prioritise TOS marked and SSH packets to class 10. Web, ACKs and other high priority traffic are marked for class 20.

Beneath this are companion rules for traffic we want to prioritise on the downstream. These must only be for class 10 traffic.

Note if you ever want to add a new port, protocol or IP address for shaping you can do it just by creating another rule and marking packets accordingly. If you have a new game or program and you don't know which port or protocol it uses, start it up, open a command prompt in Windows and type: **netstat -a**. Look for the connection your machine has initiated, note the protocol and port, and add these to atomic.firewall. To see which rules are in effect, run: **iptables -t mangle -L**.

Shaping downstream

All of what we've covered so far applies just to outgoing traffic. What about incoming?

The same rule holds true for moving the queue to the Linux box – we throttle the link. This is well and good, but what about prioritising traffic? The short answer is you can't, not directly anyway – remember you can only shape what you *send*.

However we can fudge this a little, and for this we rely on the nature of TCP/IP and some tricky filtering.

As a self-regulating protocol TCP/IP will automatically reduce its speed if packets start to go missing. It'll lower the rate until it finds a sweet spot, and then do its best to push the limit when it can. By simply dropping packets we can reduce the rate until its below that of your connection, thereby emptying the ISP's queue. This makes a huge difference to responsiveness on a saturated link. Even with a full speed download in progress, throttling allows packets to arrive as fast as they can, as they're no longer caught up in a queue.

We do this by using the ingress qdisc. Open up /etc/atomic.shaper again and scroll down to the 'INGRESS' section. You can see the tc command that attaches the ingress qdisc, followed by a command to attach a special police filter – this filter quite literally polices the link, dropping anything coming in faster than the specified rate.

Note that while we can't shape what comes in, we can selectively police packets. You'll see the filter only picks up packets marked as bulk – our high priority classes will come right though unhindered. This is ideal, as dropping these packets will cause slight bumps in the streams. However it also means that the combined speeds of these packets plus the bulk class must not exceed the speed of your link, or the queues at the ISP will fill again. This is why it's important to properly tune your throttling rates, which is what we will take a look at next.

Setting the rates

At the top of the AUS script you can set the Ethernet device, the downstream and upstream values, and the downstream burst rate.

Start by setting the 'UPSTREAM' and 'DOWNSTREAM' in kilobits to around 20% less than the advertised speed of your

link. Don't worry, shaping works off real throughput, so putting in a value 20% less may in fact still be exceeding your link, and thus not throttling it. Cable users have much more headroom available here than ADSL users.

For example, I have 512/128Kb/s ADSL connection. Theoretically my maximum download speed is 64Kb/s (bits to bytes, 512 divided by 8), but in reality due to TCP/IP overheads, PPPoE overheads, and other ethereal influences, I normally only get about 54Kb/s maximum. This translates to 430Kb. Sure enough if I set my 'DOWNSTREAM' to 450, for example, my link doesn't get throttled. At 420, it does.

Find a place where you know you can download a large file at full speed. Start the download, run **/etc/atomic.shaper**, and then run it again with the status switch: **/etc/atomic.shaper status**. Run it every couple of seconds and watch for dropped packets where it says 'qdisc ingress'. If packets aren't being dropped, lower your 'DOWNSTREAM' value,

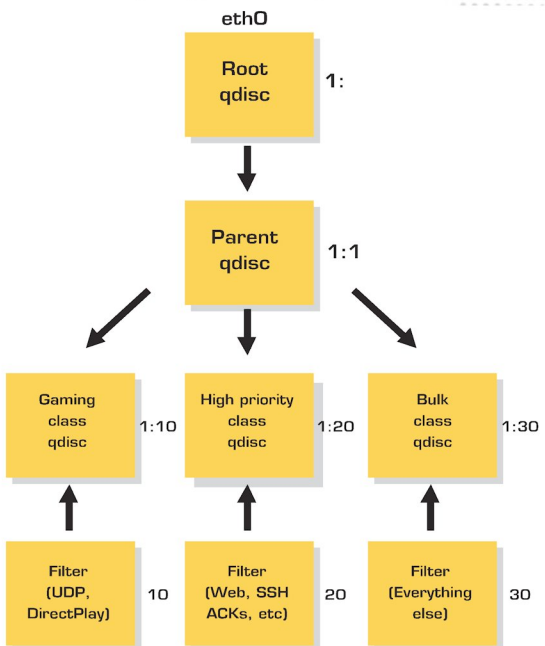


Figure #1: A basic flow tree for the AUS. Technically the filters are actually attached to the root qdisc, but feed into our three classes.

re-run the script and check again.

Repeat this process until you start to see packets being slowly dropped. If packets are being dropped at about one a second you've hit the perfect level. If they're being dropped rapidly, raise your limit up. Remember the idea is to move the queue to the Linux box while still making maximum use of your connection bandwidth.

Now knock 20Kb off this value. This is to leave room for the class 10 high priority traffic we don't police on the ingress (if we don't make room for it, the ISP queue will fill, causing those unwanted delays).

Ultimately you lose some of your maximum download bandwidth by doing this – however being able to download at 90% of your link speed while playing games is far better than not being able to download at all!

For 'UPSTREAM' stick with the 20% estimation. It's not so important you max out your upstream, but it's *very* important that it's low enough for you to control the queue (again see 'The law of ACKs' sidebox).

As an example, for my 512/128Kb/s ADSL connection I use 390/100 for my downstream/upstream.

Tuning the rates

Now try setting off a full speed download and play an online game. Half Life is an excellent indicator as its very sensitive to realtime streams and you can enable the netgraph to see the streams with 'net_graph 1' in the console.

If the downstream is laggy and creeps up slowly, you're witnessing the queue filling up at the ISP and packets are getting delayed. Lower your DOWNSTREAM.

If the downstream is excessively spikey you can try changing the downstream BURST value. As with our bulk class, burst has a huge impact on the smoothness of a stream. I've set a default 32Kb (4KB) which should work just fine for most situations, but for a more refined stream try lowering it to 24Kb (3KB) or even 16Kb (2KB). Note you'll reduce your maximum download speed somewhat.

If your downstream is spikey while only uploads are going (say from P2P software) lower your UPSTREAM value.

After using the shaper for a while a healthy status output might look something like this:

```
qdisc ingress ffff:
  Sent 161745752 bytes 202476 pkts (dropped 3651, overlimits 0)
qdisc sfq 30: quantum 1514b perturb 10sec
  Sent 46676298 bytes 32719 pkts (dropped 0, overlimits 0)
qdisc sfq 20: quantum 1514b perturb 10sec
  Sent 5049381 bytes 85239 pkts (dropped 0, overlimits 0)
qdisc pfifo 10: limit 25p
  Sent 6635083 bytes 74698 pkts (dropped 0, overlimits 0)
qdisc htb 1: r2q 2 default 30 direct_packets_stat 0
  Sent 58360762 bytes 192656 pkts (dropped 0, overlimits 174530)
```

We can see our qdiscs, dropped packets on the ingress, and overlimits caused by our rate limited bulk class doing its job. Hurrah!

Conclusion

Once you've balanced the rates put /etc/atomic.shaper in your startup scripts and enjoy. You'll find you can browse smoothly and play games even while P2P software and downloads are going full ball.

After a while you even forget there was a time when you had to cancel your downloads and close Kazaa just so you could play some Natural Selection or Battlefield 1942. They will be times you can scratch out of your mental diary with a smile plastered on your face.

Congratulations on completing part 5, and making your box even more uber than it already is!

THE LAW OF ACKS:

Normally a download consists of data laden packets coming down the line, and ACKs going up.
ACK packets are small 'acknowlegement' responses TCP/IP sends to confirm the receipt of a packet. If ACKs don't arrive at the sender, the sender resends the packet that didn't make it.
Saturated upstreams, and thus delayed ACKs, will cause the downstream to suffer even if the downstream is under-utilised. This especially holds true for games, even using UDP.
This is why we cap the bulk class, set low burst rates, and prioritise ACKs in the high priority class, leading to clean and fast downstreams. Additionally, downloads will be faster, especially in P2P software while uploading. As an aside you should limit P2P software to two concurrent uploads and downloads to prevent overheads impacting performance.

COMPETITIONS

bluechip infotech

AOpen Disc Steno

These days, CD burners are about as exciting as watching a cat puke after chowing down on a pile of freshly cut lawn clippings. However, whack on six different card readers to an external drive that can burn data from any of these slots onto a CD, without the need for a PC, and you have a CD burner that is cool again. Which is exactly what the AOpen Disc Steno is. It's even has USB 2.0 for when you do get around to plugging it into a PC. Thanks to the lovely ladies at Blue Chip IT, we have one of these $550 gadgets to throw your way, which should help appease the burning sensation you now have in your crotch.

Q: How do you get Pikachu to board a bus?

Rise of Nations

Nations rise, and nations fall – usually around the same time the US invades said nation with 250,000 troops and trillions of dollars worth of things that go boom. Which leads us to our next super duper, wee-your-pants-in-excitement giveaway. Six copies of the smash hit Rise of Nations are up for grabs, and you can shout out your big ups to Microsoft for this generous donation. If you're a wannabe rapper, that is. Normal people can probably make do with saying 'thank you', because Rise of Nations is shaping up to be a killer RTS – even the ADD-inflicted FPS fans in the *Atomic* offices are having fun with this title.

Q: What is blue and yellow and found at the bottom of a swimming pool?

Splinter Cell

You have to feel sorry for evil henchmen. Most of the time, all they have to do is walk up and down a hallway taking the occasional ciggie/toilet break, making it one of the slackest jobs known to man. Who *wouldn't* want to be one of these goons? At least until some hero type comes along and starts dealing justice with 9mm lead Tic Tacs.

If you have a thing against these semi-innocent louts, you might be interested in this competition. We have three Splinter Cell packs to give away and if you win, you can pick which version of game (Xbox, PC, GC or PS2) you want. And that's no diet coke of evil.

Q: How do a blonde's brain cells die?

ATOMIC SUBSCRIBER PRIZE

Atomic is like the X-Men – constantly evolving to kick some serious booty – with the exception that it doesn't have a 100% probability of making you an exile from the human race. Our latest chromosomal mutation is a whole new competition for existing subscribers. We have four bundles of four books from the Sybex Complete series – each bundle is valued at $160. These bundles promise to turn you into one l337 computer dude. Each package includes XHTML Complete, Internet Complete, PC Complete and the oh-so-helpful Linux Complete books. Take your hats off to Woodslane (www.woodslane.com.au) for donating these brain-busting book bundles.

Q: Why did the math book commit suicide?

EMAIL ENTRIES TO WIN@ATOMICMPC.COM.AU OR POST THEM TO: *ATOMIC*, PO BOX 275, BEACONSFIELD NSW 2014. PLEASE SEND A SEPARATE ENTRY FOR EACH COMPETITION. PLEASE ENSURE THE COMPETITION NAME IS THE SUBJECT OF THE EMAIL, OR IS DISPLAYED CLEARLY ON THE FRONT OF THE ENVELOPE. THE CLOSING DATE FOR ENTRIES IS 16 JUNE 2003. WINNERS WILL BE ANNOUNCED IN *ATOMIC 32*.

Atomic 28 winners: Thermaltake Xaser III V1000C: Q. What accelerant was used for the creation of *Atomic* 10's cover? A. Lighter fluid. M Williams, Mt Riverview, NSW. Video Logic ZXR-550: Q. What homeworld-less race attacked in Master of Orion 2? A. The Antarans. M Cohen, Lindfield,NSW. VIA EPIA-M9000: Q. What health risks does an all-Perspex case pose? A. Electromagnetic radiation A Mujaj, Bridgeman Downs, QLD.

Terms and Conditions of Entry. 1. The promoter is AJB Publishing Pty Ltd (ACN 083 063 914) of Unit 2-5/44-70 Rosehill Street, Redfern NSW 2016. Promotion period is from 9.00am on 21.06.03 until 12.00pm on 16.07.03. 2. Entry is open to residents of Australia and New Zealand. Management and employees of AJB Publishing Pty Ltd and their immediate families, and any advertising, marketing or promotional firms associated with this promotion are not eligible to enter. 3. Enter by posting or emailing forms to AJB Publishing Pty Ltd. 4. The draw will be held at the offices of AJB Publishing Pty Ltd at 5.00pm on 16.07.03. Winners will be notified by mail and published in *Atomic 32*. The prizes are not transferable or exchangeable. 6. The judges' decision is final and no correspondence will be entered into. 7. The promoter reserves the right to publish the winner's name and suburb for promotional purposes. 8. All entries will become the property of AJB Publishing Pty Ltd.

Cape fear

Super John Simpson and his underpants – just seeing them on his head had us terrified.

Superheroes are cool. I knew this years ago: I'd spend all my pocket money on comic books and run around the house with my underpants on my face, thinking I could save the world. My front yard was Lower Manhattan, and the kids that jeered at my costume were the bad guys, just waiting to get webbed.

Not much has changed. I still spend my spare change on comics (now I call them *collectables*), and the underpants have been replaced by Clark Kent-style glasses. My house is a mini-statue shrine –porcelain icons in vivid colours, each straining to leap from their individually-numbered pedestals. And my cupboards bulge with memorabilia, including a tailored Superman costume (for those *special* occasions, as the girlfriend can attest).

Once, we superfanatics were ridiculed and mocked ('Underpants Man!' they'd say. 'How's your super smell?'). But with the popularity of movies such as *X-Men 2* and *The Matrix Reloaded*, suddenly we're not looking so dorky. It's as if the world has come to realise that people with super powers can be cool, even if their costumes aren't.

While we can thank the movies for raising superhero popularity, there's another medium that's pummeling it: computer games. Almost every game based on super characters has been dismal. Take the woeful *Superman* for the N64. . . I still shudder when I think of the poor, pixilated blob bouncing from building to building, crushing expectations faster than a speeding bulldozer. Then there's the *Streetfighter* rip-offs, pairing Marvel characters against Capcom. Never has Wolverine looked so prissy, and his costume so. . . comical.

Spiderman was an improvement, although web-swinging across an empty sky hardly screams *realism*. And the latest *Superman: Man of Steel* for the Xbox really makes you believe a man can cry. I have trouble explaining to my girlfriend that Superman is invulnerable, when he keeps smacking his head on bridges and dying from laser blasts. Makes you feel about as super as Sandman with a stutter.

As technology progresses and superheroes remain in the limelight, there'll be a growing market for these games. That's fine, as long as we don't see repeats of previous efforts.

So, to help game makers build the perfect superhero game, here's some tips, straight from the hoarder's mouth:

1. Don't start the game with some lame-arse storyline about aliens invading earth, or how we got our powers. Aliens are so cliché, and we've already seen the movie.

2. If we fly, presumably we can do it without bumping into things. Give us automatic obstacle avoidance. Or at least blank the screen or make noises if we hit something.

3. If we swing, remember that clouds aren't solid and our webs/ropes won't stick. Maybe fill the sky with blimps, or give us jetpacks.

4. Make all voice actors Jon Voight. Other voices suck.

5. When we punch things, we want the earth to shake. None of this girlie smack stuff. Things should either bruise or burst.

6. We want to be able to pick up *anything*. Busses, buildings, foreign embassies. Superheroes should be equipped for urban planning.

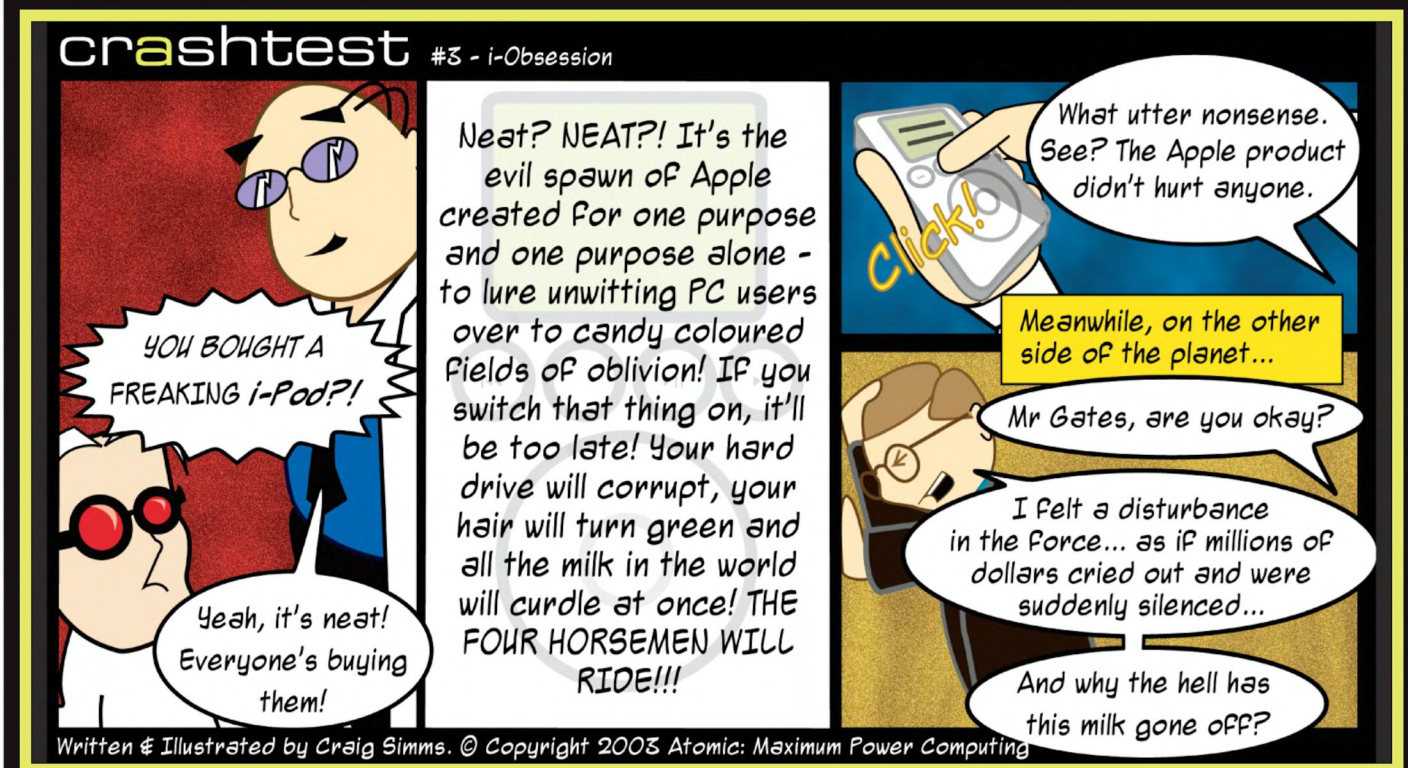
7. We want reverence from the public –lots of 'oohs' and 'aahs' each time we flex. Cheers are acceptable, as are statues and shrines.

8. We want to be able to spin and dig – Superman digs in every movie, so we should too. For no apparent reason.

And finally, the most important part of being a superhero –we want to decide what we wear. Every superhero goes through their own costume-building exercise, and so should we. If we don't want a cape, we don't have to have a cape. If we're comfortable wearing underpants on our faces, then that's what we'll do. And no matter what we wear, the public will blindly accept it.

If game companies follow these simple steps, superhero games may start to rival the movies in popularity. Hell, they might even become the next big thing at LAN-fests: everyone turns up in their own costumes, ready to sock it out. Cape or no cape.

Sounds good, yeah? So, if you'll excuse me, I have to rummage through my cupboard for my old costume. Then I'm going shopping for a new pair of underpants.



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